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For further information, write to

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INDEX TO ADVERTISERS

Abrams Aerial Survey Corp. 126
Aero Service Corporation ..... Cover 2
Air Survey Corporation 231
American Air Surveys, Inc. 231
Wm. Ainsworth & Sons, Inc. 140
American Paulin System ..... Cover 4
Bathey Manufacturing Co. 125
Bausch & Lomb 223
C. L. Berger & Sons, Inc. 121
Bludworth Marine 231
Dennert & Pape 224
Eugene Dietzgen Co. 158
Edo Corporation 226
Fairchild Aerial Surveys, Inc. 128
Fennell Instrument Corp. of America 225
Filotecnica Salmoiraghi Inc. 222
Maurice Gould 231
W. & L. E. Gurley 116
Kern Instruments, Inc. 127
Keuffel & Esser ..... 124 & 221
Lufkin Rule Co. 170
Monsen 118
Ottico Meccanica Italiana 122
Park Aerial Surveys, Inc. 231
Harrison C. Ryker, Inc. 184
R. L. Sargent Co. 229
Surveyors Service Co. 182
Tellurometer, Inc. 194
Transograph Company 224
Universal Instrument Co. 188
Wallace & Tiernan 123
Warn Manufacturing Co. 120
Warren-Knight 226
Wild Heerbrugg Instruments, Inc.. .. Cover 3
Zeiss-Aerotopograph 119

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SURVEYING AND MAPPING

Editor-in-Chief
Howard S. Rappleye,

A QUARTERLY JOURNAL
DEVOTED TO THE ADVANCEMENT OF THE SCIENCES
OF SURVEYING AND MAPPING

Volume XVII, No. 2
April–June 1957

PUBLISHED BY THE
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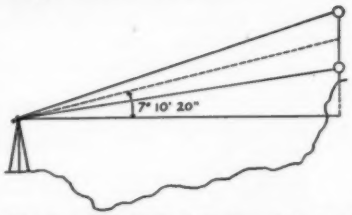

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Contents

Volume XVII
Number 2

INDEX TO ADVERTISERS 114

INTRODUCING THE NEW PRESIDENT OF ACSM 129

THE SEVENTEENTH ANNUAL MEETING 131

SURVEYING THE NEW HIGHWAY PROGRAM 141
C. D. Curtiss

THE PART OF CONTROL SURVEYS IN THE PRESIDENT'S ROAD PROGRAM 145
William T. Pryor

THE COAST AND GEODETIC SURVEY AND THE HIGHWAY PROGRAM 151
I. E. Rittenburg

GEODESY—A FRAMEWORK FOR MAPS 154
Clement L. Garner

INTERPRETATION OF DEED WORDS 159
Curtis M. Brown

A FORMULA FOR THE PROBABLE ERROR IN AN INACCESSIBLE BASE RESECTION 162
Erwin Schmid

GLENAD 171
Donald W. Stipp

RECENT TRENDS IN AERONAUTICAL CHARTING 179
Frank E. McClung

TRIVIA 183
Clarence L. Hunter

THE INTERAGENCY COMMITTEE ON MAP AND CHART SYMBOLS 185
C. F. Fuechsel

LIBRARY HAS MAPS OF ALL PLACES 187
Barbara P. Berthelsen

SURVEYING AND MAPPING NEWS 189

MAP INFORMATION 196

MESSAGE FROM THE PRESIDENT REGARDING A.S.C.E. REPORT ON STATUS OF SURVEYING AND MAPPING 202

REPORT ON STATUS OF SURVEYING AND MAPPING 203

COMMENT AND DISCUSSION 206

NEWS OF RELATED ORGANIZATIONS 210

CONGRESS NEWS 211

NEW MEMBERS 213

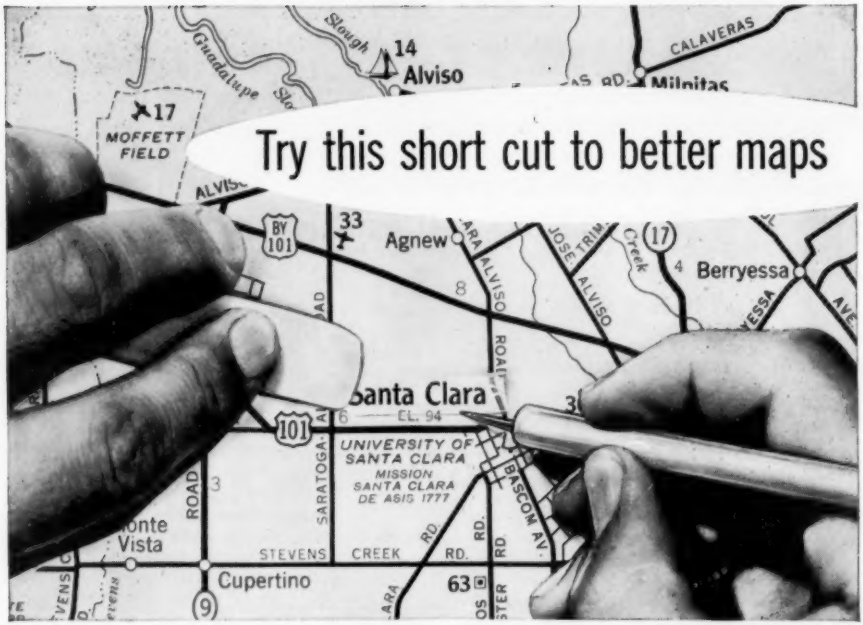
SUSTAINING MEMBERS 217

CONGRESS DIRECTORY 218

MEMBERSHIP APPLICATION BLANK 219

NOTICE ON ORDERING REPRINTS 219

Opinions or assertions expressed in articles in this Journal do not necessarily represent the official views of the CONGRESS.



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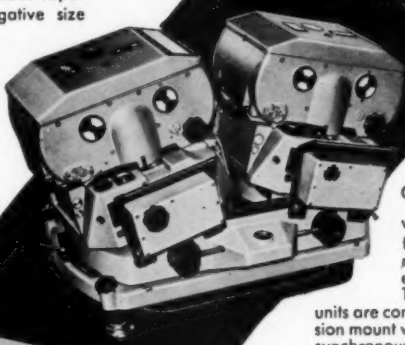

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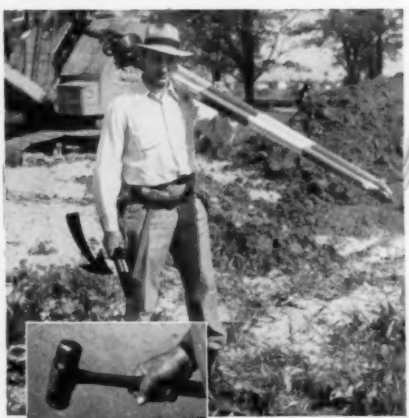

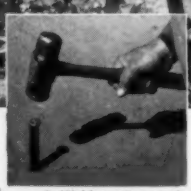

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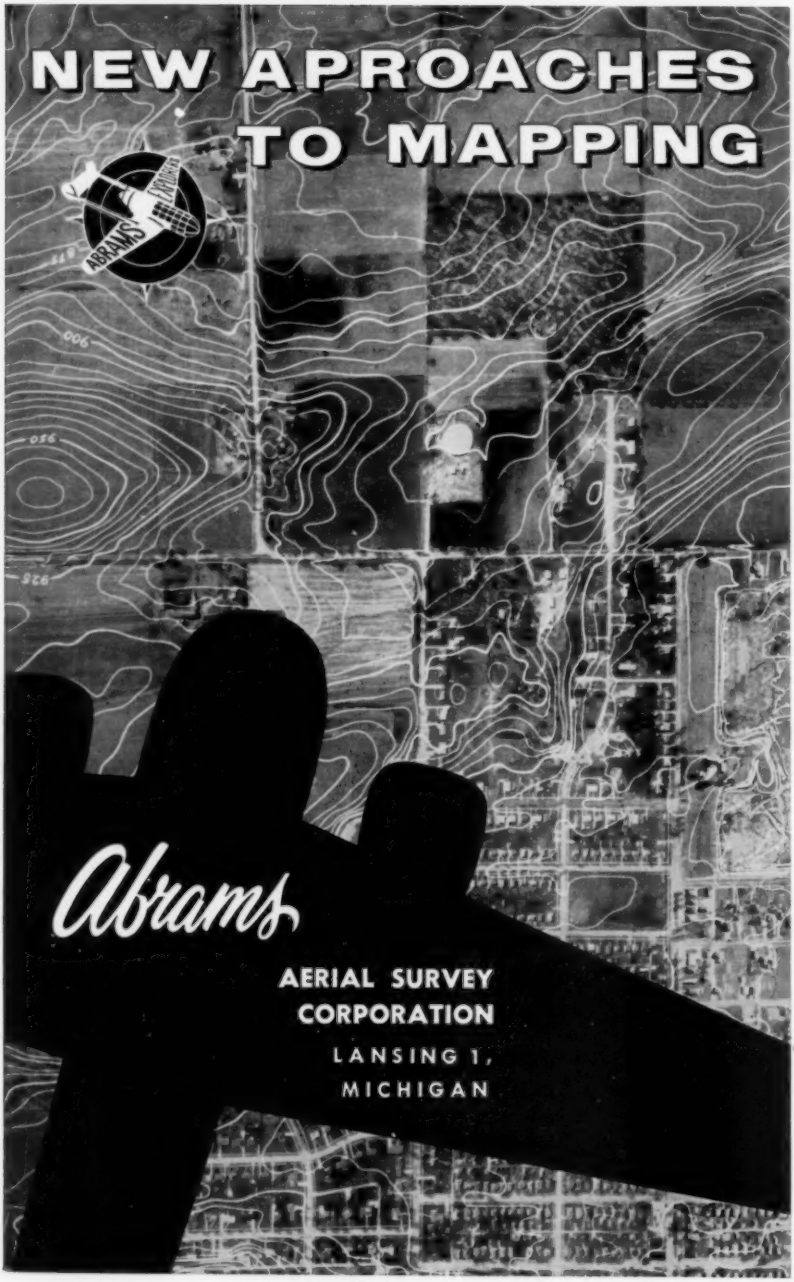
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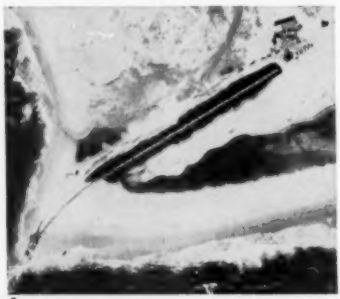

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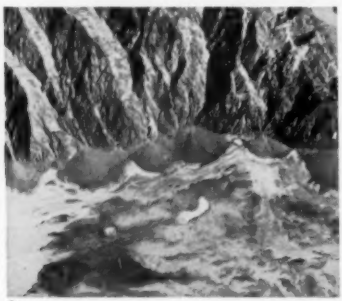

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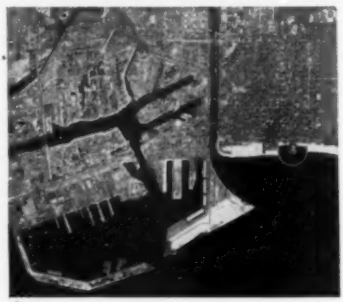

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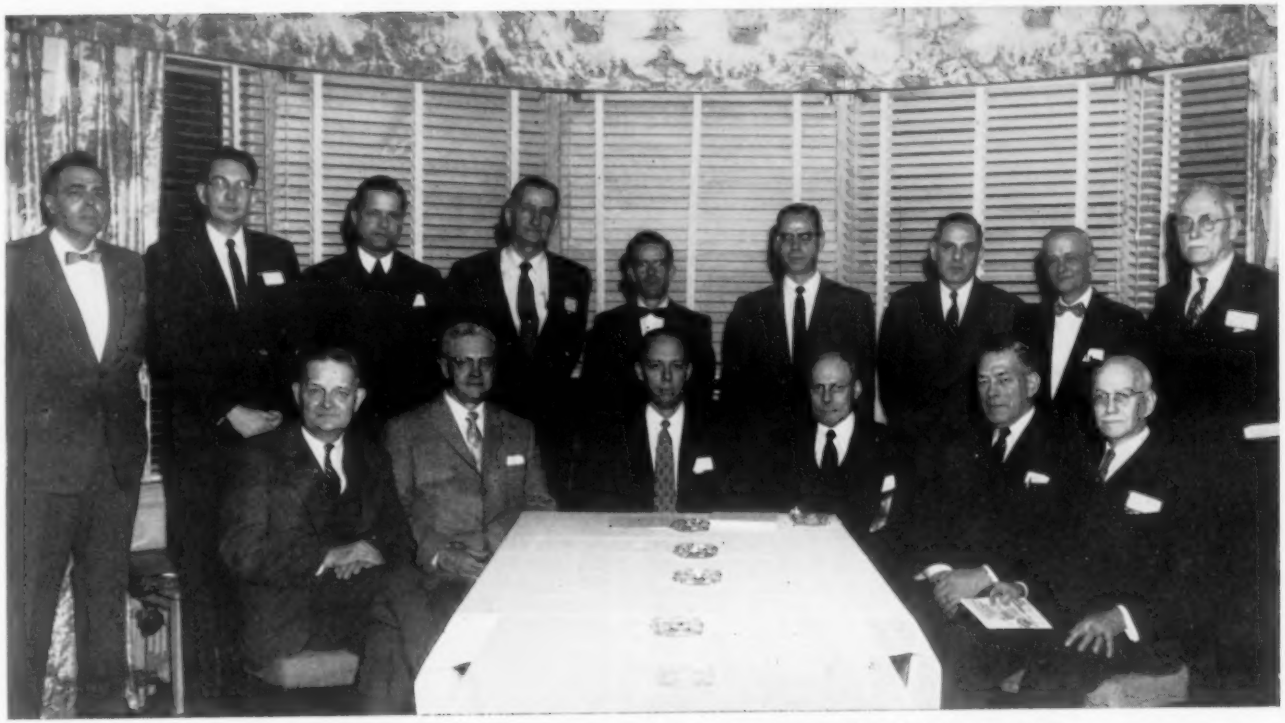
PRESIDENT ROBERT H. LYDDAN

In addition to his service as Director of ACSM, Mr. Lyddan has served as Chairman, Surveying and Mapping Division, American Society of Civil Engineers; and as Director, Washington Society of Engineers. He is a members of the American Society of Photogrammetry and the Society of Military Engineers.

In November 1943, he was married to Anne Casey of Cambridge, Mass. They live at 3101 Beech Street, N.W., Washington, D. C., with their three children.



ACSM OFFICERS 1957—BOARD OF DIRECTION MEETING, MARCH 8, 1957

Front row, left to right: H. W. Hemple, Treasurer; L. C. Higbee, Past President; Robert H. Lyddan, President; W. S. Dix, Executive Secretary; W. B. Williams, Vice President; R. T. Evans, Past Treasurer. *Back row, left to right:* Directors—V. H. Ghent, K. S. Curtis, Bro. B. Austin Barry, S. P. Chapman, R. C. Eller, L. A. Bloom, I. E. Rittenburg, W. C. Crump, and Editor-in-Chief H. S. Rappleye

The Seventeenth Annual Meeting

THE American Society of Photogrammetry and the American Congress on Surveying and Mapping held their annual Consecutive Meetings and Co-Exhibits at the Shoreham Hotel in Washington, D. C., during the week of March 3. The ASP opened the week with its Twenty-Third Annual Meeting and ACSM closed the week with its Seventeenth Annual Meeting.

More than 1,700 persons registered for the two meetings. The number of visitors and guests from foreign countries was unusually large and the various sections of the United States were well represented. Throughout the meeting members from New England, the Southeastern States, the broad Middle West, and the Far West were renewing former friendships and making many new ones.

The keynote address was given by Major General R. Ll. Brown, President, International Society of Photogrammetry. General Brown is the former Director of the Ordnance Survey of Great Britain and is well known in all countries. His many friends in the United States were pleased to have the privilege of hearing him at this meeting. In his remarks, General Brown stressed the importance of participation in International meetings with particular emphasis on the preparation of material to be presented at these meetings and preliminary briefing for the participants at the meetings.

The various social functions of the week were held jointly. The Technical Division meetings and Plenary Sessions were separate but were open to all registered, regardless of organization affiliation.

Plenary Sessions

The six Technical Divisions were responsible for the organization of the Plenary Sessions and brief summaries of these sessions are listed in the following division reports. Inasmuch as there were only four Plenary Sessions, some of the Divisions had to share with each other the morning or afternoon sessions.

CARTOGRAPHY DIVISION

The accomplishments of the Cartography Division were submitted in the Annual Report for the year ending March 8, 1957, by Chairman Robert H. Randall, Jr.

One of the highlights of the year was an innovation in the activities of the Congress —a daytime workshop discussion held October 12, 1956, on methods used to schedule and control map and chart production. Representatives of governmental and commercial cartographic organizations described the problems characteristic of their operations and summarized the techniques developed to overcome them. Aside from giving the assembled specialists an opportunity to exchange information on a phase of cartographic operations that has received little organized attention, the workshop made it possible to survey agency practices and to select significant phases deserving fuller explanation. The first formal presentations on production scheduling and control procedures have been incorporated in one of the Cartography Division's sessions during the 1957 Annual Meeting of the Congress.

Program arrangements for this workshop were handled by Granville K. Emminizer. He also coordinated the Division program for the 1957 Annual Meeting and the evening meeting of November 15, 1956, which featured presentations on the Esselte Cartographic Conference, aeronautical chart developments, and the new BS in Cartography degree offered by George Washington University.

Dr. Walter W. Ristow, Publications Committee, actively sought contributions throughout the year for the Journal, for which he also edited articles submitted on cartography. Six articles, six special features, and two book reviews on cartography were published in the Journal in 1956. The division also recommended that the Congress authorize its Editor to have prepared a cumulative author and subject index for all Journal articles so far published.

Dr. Arch C. Gerlach undertook the formation of a 15-member Technical Standards Committee which met and discussed the extent of technical standards that commercial and governmental cartographic agencies have adopted or believe should be adopted. The Committee has already arranged for preparation and publication in the Journal of a report on the purpose and functions of the Interagency Committee on Map and Chart Symbols. The Committee expects to submit for later publication copies of standards in use by cartographic agencies and to explore areas in which cartographic standards might be of value.

Joseph P. Dunich, Membership Committee, promoted acquisition of new members during the year. Of the more than 4,000 members of the Congress, 514 (a 15 percent increase over last year) now have their addressograph plates tagged so they can be selected for mailing of notices and literature relevant to their special interests in cartography.

The Directors also amended the By-Laws of the Division relative to the selection of new Directors, as follows:

"An ad-hoc Appointing Committee shall be named by the Executive Board in January to appoint two persons to serve two-year terms as Directors. The Directors shall elect from among themselves a Chairman and a Vice Chairman."

The two new Directors appointed under these By-Laws are Granville K. Emminizer, Jr., and Duncan M. Fitchet.

The Cartography Division's contribution to the plenary sessions consisted of two papers presented by representatives of two of the outstanding governmental mapping agencies.

Captain Elliott B. Roberts, Chief, Geophysics Division, Coast and Geodetic Survey, Washington, D. C., marked the Sesquicentennial of the Sruvey in a speech entitled "150 Years of the Coast and Geodetic Survey."

Colonel Richard W. Philbrick, Commanding Officer of the USAF Aeronautical Chart and Information Center, St. Louis, Mo., presented a paper entitled "New Design Features for the World Aeronautical Chart."

The following is a resume of the six papers presented at the Division's two meetings held during the Seventeenth Annual Meeting of ACSM:

The first meeting on Thursday evening was presided over by the new Chairman, John Law, in the absence of Robert H. Randall, Jr., the outgoing Chairman. The theme of this meeting was "Production Scheduling and Control Procedures" and included the following papers.

Ducan M. Fitchet, General Manager of the Creative Division, Rand McNally and Company, Chicago, Ill.—"An Experiment in Time and Motion Study and Cost Control for Cartographic Work."

Thomas C. Finnie, Chief, Production and Distribution Plant, USAF Aeronautical Chart and Information Center, St. Louis, Mo.—"Tools for Controlling Chart Production and Reporting Progress."

Frederick W. Winkelman, Chief, Statistical Analysis Division, Office of the Comptroller, Army Map Service, Washington, D. C.—"Cartographic Production Control by Electronic Data Processing Methods."

The second meeting held Friday morning was presided over by Program Chairman, Granville K. Emminizer, Jr., who presented the following speakers:

Lt. Col. Lavoi B. Davis, Chief, Requirements Division, USAF Aeronautical Chart and Information Center, St. Louis, Mo.—"Technical Limitations of Today's Aeronautical Charts."

Patrick R. J. Reynolds, Navigation Superintendent, Atlantic Division, Pan American World Airways, New York, N. Y.—"Commercial Airline Requirements for Trans-Atlantic Charts."

Frank E. McClung, Technical Assistant to the Chief, Aeronautical Chart Branch, Coast and Geodetic Survey, Washington, D. C.—"Recent Trends in Aeronautical Charting."

CONTROL SURVEYS DIVISION

Homer C. Fuller, Chairman, Control Surveys Division, presided during the second

portion of the Friday afternoon plenary session where two papers were presented, sponsored by the Control Surveys Division.

The first paper was given by William T. Pryor, Chief, Aerial Surveys, Bureau of Public Roads, Washington, D. C., and was entitled "The Part of Control Surveys in the President's Road Program."

In highway construction on a national basis, there is need for a basic coordinated system of control surveys. The States are encouraged to make every possible use of photogrammetric methods in all stages of highway engineering, and for this adequate horizontal and vertical control is required. The Bureau of Public Roads has prepared instructions for the performance of basic control surveys which are accompanied by a statement of objectives by the Coast and Geodetic Survey. Most important State requirements will be met by establishing horizontal control markers at spacings of two to five miles and vertical control markers at a one-mile spacing along proposed Interstate Routes. Details for each project will be worked out among representatives of the State concerned, the Coast and Geodetic Survey, and the Bureau of Public Roads.

The second paper was presented by Captain I. E. Rittenburg, Assistant Director for Administration, Coast and Geodetic Survey, Washington, D. C., and was entitled "Coast and Geodetic Survey Participation in the Highway Act of 1956."

Captain Rittenburg brought out the fact that the Federal Aid Highway Act of 1956 authorizes the cost of establishing geodetic control along proposed routes of the Interstate Highway System. These surveys would not only be advantageous for use in the Interstate Highway System but also for other types of surveys including property and engineering. It would also assure that piecemeal surveys, which might otherwise be based on assumed or arbitrary datums, would fit both statewide and nationwide. The initiative must be taken by the States. Coast Survey cooperation and participation can be tailored to the desires of any State by furnishing all of personnel and equipment; part of the personnel and equipment; or supervisory personnel only. Projects are being undertaken in four States in relation to the Interstate Highway program, namely, Washington, Oregon, Nevada, and South Carolina.

The meeting of the Control Surveys Division was called to order at 10 a.m., Friday, March 8, 1957, in the South Room, by Chairman Homer C. Fuller of the Army Map Service. There were 102 persons who attended the meeting. This was an overflow for the size of the room. Next year a larger meeting room should be reserved, if possible. After a few remarks of welcome, Chairman Fuller introduced the Past Chairmen who were present. These included:

Captain H. W. Hemple
Colonel Floyd W. Hough
Carroll F. Merrian
Captain Albert J. Hoskinson
Professor Milton O. Schmidt
E. D. Morse

Reports were given by the chairmen of the standing committees, as follows:

Membership—Emery T. Snyder
Technical Standards—William T. Laidly
Public Education—Prof. Ralph M. Berry
Research and Development—Julius L. Speert
Nominating—Capt. Albert J. Hoskinson

The Nominating Committee presented the name of Lansing G. Simmons, Chief Mathematician, Geodesy Division, Coast and Geodetic Survey, Washington, D. C., for Director. There were no nominations from the floor and Mr. Simmons' election was unanimous.

The Control Surveys Division operates under the guidance of three directors—one elected each year to serve for three years and serving as Chairman during his third year. In the past, the Division has operated on a calendar-year basis, but there is need for the new officers to assume their duties soon after the annual meeting. Therefore, it was moved, seconded, and passed that new officers assume their duties one month after the date of each annual meeting. The Board of Directors for the period April 1957 to March 1958 are Professor Arthur J. McNair, Cornell University (Chairman);

Robert G. Blanchard, Trenton, New Jersey; and Lansing G. Simmons, Coast and Geodetic Survey, Washington, D. C.

In the absence of Robert H. Randall, Bureau of the Budget, Charles A. Whitten, Chief, Triangulation Branch, Coast and Geodetic Survey, Washington, D. C., reported on the present status of "Classification and Standards of Accuracy of Geodetic Control Surveys."

Mr. Whitten stated that about three years ago, Mr. Randall invited members of various mapping and surveying organizations of the government to consider a revision of the existing specifications drawn up in 1933 by the Federal Board of Surveys and Maps. This was done and preliminary drafts were submitted to interested organizations and individuals for comments. The comments were then gone over and a final draft has now been prepared and submitted to the Bureau of the Budget for approval. When approved, the specifications will be available to all interested parties. It is intended that they will serve as a guide not only to Federal and State organizations but also for private surveyors and educational institutions.

William T. Laidly, Chief Technical Assistant, U. S. Lake Survey, Detroit, Mich., presented a paper on "A New Vertical Control Datum for the Great Lakes." Leonard W. Andrukonis, Project Engineer, U. S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., presented a paper on "Current Investigations at the Surveying and Geodesy Branch of the Engineer Research and Development Laboratories." William Aumen, Geodesist, U. S. Army Map Service, Washington, D. C., presented a paper on "Small Electronic Computers for Geodetic Survey Computations."

EDUCATION DIVISION

The first half of the first Plenary Session on Wednesday afternoon, March 6, was given over to a Panel Discussion of the educational and professional status of the land surveyor. The panel members were selected from outstanding educators and practicing engineers.

The second half of the Plenary Session on Thursday afternoon, for which the Education Division was responsible, was given over to the presentation of papers relating to the use of electronic computers in survey operations and also in the teaching of surveying.

Professor Sumner B. Irish, Associate Professor of Civil Engineering at Princeton, N. J., presided at the Division Meeting. Professor Irish as Senior Director in the Division automatically is the Chairman for this year. The other Directors are Professor Leo V. Nothstine and Professor Frank Moffitt. Professor Eldon C. Wagner of the University of Wisconsin was elected as a new director to fill the vacancy and succeed Professor Harmer A. Weeden on the Board of Directors of the Education Division.

INSTRUMENTS DIVISION

The Instruments Division's contribution to the program for the 17th Annual Meeting set a record for attendance for this Division. The Terrace Banquet room was filled for both the morning and afternoon sessions of March 7, and quite a few members found standing room only.

The portion of the morning session, assigned to the Instruments Division, was used for a panel discussion led by Chairman Clifford A. Thorpe, Jr., assisted by representatives of equipment manufacturers who answered questions obtained from a national poll. Early last fall, Chairman Thorpe sent letters to all professional engineering and surveying organizations throughout the United States, asking their members to send in questions which could be discussed by this panel. The following company officials made up the panel:

R. M. Benjamin—Lufkin Rule Co.
Daniel H. Harkness—W. & L. E. Gurley Co.
Florian E. Davatz—Kern Instruments, Inc.
Ward Bolter—Keufell & Esser Co.
E. E. Price—Eugene Dietzgen Co.
Herb Beane—C. L. Berger & Sons, Inc.
A. F. Waldenberg—David White Instrument Co.
S. Chikofsky—Path Instruments, Inc.

After answering some of the questions sent in by different organizations, the Chairman invited questions from the floor. There was a great deal of interest throughout this session and the record of the meeting will be published in an early issue of SURVEYING AND MAPPING.

At the afternoon session Colonel John A. Ladd read a paper which had been prepared by Dr. H. E. Howlett, Director, Division of Applied Physics, National Research Council of Canada, on the Tellurometer, a new instrument using the microwave system for precise measurement of distance. It was pointed out in Dr. Howlett's paper that the tellurometer has the following characteristics:

(1) Sufficient accuracy to permit use with confidence for first-order triangulation,

(2) Sufficiently simple in operation, to be employed in the field by surveyors or others not skilled in electronics,

(3) Light, portable, and easily positioned,

(4) Rugged in construction so as to enable its use for long periods without undue problems of maintenance, and

(5) Versatile to the extent that satisfactory measurements can be made under all reasonable meteorological and geographic conditions.

In the Division business meeting, the following officers were elected for next year:

Chairman—Clifford A. Thorpe, Jr., of Thorpe-Smith, Inc., Falls Church, Va.

Secretary—Raymond L. Sargent of the R. L. Sargent Co., Houston, Texas.

PROPERTY SURVEYS DIVISION

Gordon E. Ainsworth, Chairman of the Property Surveys Division, presided during portions of two of the Plenary Sessions. On Wednesday afternoon he introduced Father Daniel Linehan, S. J., Director of Weston Observatory of Boston College, who gave an illustrated lecture on recent polar survey expeditions. Father Linehan vividly described expeditions into both of the polar regions and illustrated his remarks with excellent colored slides.

On Thursday afternoon, Mr. Ainsworth introduced Armand Dumas, a member of the Canadian Parliament, who spoke on Canada's North Land—and Its Survey Problems. Mr. Dumas told of the development of the resources in his country, stressing the importance of surveying and mapping in the development of these resources.

The Property Surveys Division held two Division meetings which were very well attended and of unusual interest. At an evening session there was an open discussion, conducted in a town-meeting style, where matters of current issue and interest to professional land surveyors were discussed.

In this evening session, Harold J. Welch, Consulting Engineer, Registered Land Surveyor, Denver, Colo., presented techniques for standardizing computations in subdivision work.

On Friday morning the Property Surveys Division held another meeting at which two representatives from the National Labor Relations Board were present to discuss and answer questions relating to fair labor standards: Mr. Goldberg, Chief of the Administrative Policy Branch, and Mr. Hoffman, Chief of the Regulations Branch, both of the Department of Labor.

The new officers for the Division are:

Chairman, A. Phillips Bill, South Deerfield, Mass.

Vice Chairman, Arnold Lundgren, Rockford, Ill.

Secretary, Victor H. Ghent, Annandale, Va.

Director, H. C. Howard.

TOPOGRAPHY DIVISION

The Topography Division met on Friday, March 8, with Division Chairman Roland H. Moore presiding. Chairman Moore briefly outlined Division activities during the past year and then introduced Program Chairman Milton F. Denault to present the program.

The program was opened with two related papers on the current U. S. Geological Survey mapping project in Northern Alaska. The first paper, "Aerial Photography for Mapping Alaska's Brooks Range" was presented by Hugh B. Loving. Mr. Loving explained the plan for obtaining transverse low-oblique photography of the 121,000 square mile project area. He then de-

scribed the successful operation of obtaining the complete photographic coverage in two summer seasons, despite unusually difficult and hazardous conditions.

The second paper, "Field Operations for Mapping Alaska's Brooks Range" was presented by J. E. Mundine. Mr. Mundine described the logistical and operational problems of obtaining field-survey control for photogrammetric aerotriangulation of the transverse low-oblique photography. Photo-trig traverse lines were run in the field perpendicular to the flight lines. Each field party utilized two helicopters for transportation and a fixed-wing aeroplane for logistical support. Walkie-talkie radios permitted constant communication between members of each field party and helped synchronize the reading of simultaneous reciprocal vertical angles. Mr. Mundine also showed motion pictures of the field operations.

In a paper on "Special Uses of Contour Maps," Louis C. Peltier, U. S. Geological Survey, demonstrated the relationship between variations in terrain and specific economic activities such as construction, manufacturing, and marketing. Mr. Peltier illustrated graphically the effect of factors such as slope of terrain and density of drainage ways on the cost of various endeavors.

Edward E. Welsh, of the Corps of Engineers, presented the final paper, "Value of Topographic Surveys and Maps to the Corps of Engineers, U. S. Army, South Atlantic Division." Mr. Welsh traced the history of topographic mapping in the southern States and outlined the responsibilities of the South Atlantic Division in mapping. The services of private mapping concerns are used extensively by the Division. Specifications governing contracts with private organizations generally cover only the quality of the product, with methods left to the discretion of the contractor.

In a business meeting following the program, Chairman Moore introduced John B. Rowland, Secretary of the Topography Division. Mr. Rowland announced the following list of officers of the Division, elected for 1957:

Chairman—Joe K. Bailey

Directors (3 years)—Tracy L. Atherton and Joseph P. Burns

Directors (2 years)—Harold Williams and Page F. Hopkins

Outgoing Chairman Moore then turned over his office to incoming Chairman Bailey. In his remarks closing the session, Mr. Bailey expressed the hope for a year of renewed activity by the Topography Division.

Exhibits

The third combined ASP–ACSM exhibit was a very successful project. The committee in charge of arrangements for the exhibits deserves a great deal of credit for the extensive and well organized showing. The exhibits were officially opened at 8 p.m. on Monday and remained open during the following three days. Seventy-five exhibit booths were provided for commercial exhibitors, and 21 booths were provided for the noncommercial exhibitors, Some exhibitors occupied two or more contiguous booths. Only one commercial exhibitor failed to appear with the planned exhibit and the same applies to the group of noncommercial exhibitors.

Commercial exhibitors participating in the 1957 combined ASP–ACSM exhibit were as follows:

Abrams Aerial Survey Corp., Lansing, Mich.

Abrams Instrument Corp., Lansing, Mich.

Aero Service Corp., Philadelphia, Pa.

Air Photo Supply Corp., New York, N. Y.

American Hoppi-Copter, Inc., Washington, D. C.

Ansco Division, General Aniline and Film Corp., Binghamton, N. Y.

Askania-Werke, A. G., U. S. Branch Office, Bethesda, Md.

Bausch and Lomb Optical Co., Rochester, N. Y.

Bendix Computer Division, Bendix Aviation, Los Angeles, Calif.

C. L. Berger and Sons, Inc., Boston, Mass.

Chicago Aerial Industries, Inc., Chicago, Ill.

COOPER-TRENT, INC., Washington, D. C.
EUGENE DIETZGEN CO., Washington, D. C.
DIRECT REPRODUCTION CORP., Brooklyn, N. Y.
E. I. DUPONT DE NEMOURS AND CO., Wilmington, Del.
EASTMAN KODAK CO., Rochester, N. Y.
FAIRCHILD AERIAL SURVEYS, INC., Los Angeles, Calif.
FAIRCHILD CAMERA AND INSTRUMENT CORP., Syosset, Long Island, N. Y.
FENNEL INSTRUMENT CORP., Long Island City, N. Y.
FILOTECNICA SALMOIRÂGHI, INC., Long Island City, N. Y.
FRIDEN CALCULATING MACHINE CO., INC., San Leandro, Calif.
GEODIMETER DIVISION, BERG HEDSTROM AND CO., INC., New York, N. Y.
GEO OPTIC CO., INC., New York, N. Y.
W. AND L. E. GURLEY CO., TROY, N. Y.
HASTINGS-RAYDIST, INC., Hampton, Va.
HYCON AERIAL SURVEYS, INC., Pasadena, Calif.
INTERNATIONAL RESOURCES ENGINEERING AND EXPLORATION GROUP, Washington, D. C.
KARGL COMPANY, INC., San Antonio, Texas
THE KELSH INSTRUMENT CO., Baltimore, Md.
KERN INSTRUMENTS, INC., White Plains, N. Y.
KEUFFEL AND ESSER CO., Hoboken, N. J.
LOGETRONICS, INC., Alexandria, Va.
THE LUFKIN RULE CO., Saginaw, Mich.
MONROE CALCULATING MACHINE CO., INC., Orange, N. J.
MONSEN TYPOGRAPHERS, INC., Chicago, Ill.
GEO. F. MUTH CO., INC., Washington, D. C.
OLD DELFT OPTICAL CO., Holland
OTTICO MECCANICA ITALIANA, Rome, Italy
PHOTOGRAPHIC SURVEY CORP., Toronto, Canada
PRECISION INSTRUMENTS, INC., Troy, N. Y.
STACOR EQUIPMENT CO., Brooklyn, N. Y.
TELLUROMETER (PTY.) (LTD.), Capetown, Union of South Africa
EDGAR TOBIN AERIAL SURVEYS, San Antonio, Texas
UNITECH CORP., Clifton, N. J.
WALLACE AND TIERNAN, INC., Belleville, N. J.
DAVID WHITE INSTRUMENT CO., Milwaukee, Wis.
WILD HEERBRUGG INSTRUMENTS INC., Port Washington, N. Y.
WILLIAMS AND HEINTZ LITHOGRAPH CORP., Washington, D. C.
ZEISS-AEROTOPOGRAPH, Munich, Germany

The noncommercial exhibits were sponsored by the following organizations:

Department of the Air Force
- Rome Air Development Center
- 1370th Photo Mapping Group, APCS
- Aeronautical Chart and Information Center, APCS

Department of the Army
- Army Map Service
- Engineer Research and Development Laboratories
- U. S. Lake Survey

Department of Commerce
- Coast and Geodetic Survey

Department of the Interior
- U. S. Geological Survey

Department of the Navy
- Hydrographic Office
- Photo Interpretation Center

National Geographic Society
Special Libraries Association

Social Activities, Ladies' Program

(EDITOR'S NOTE.—We are indebted to MRS. Frank S. Borden for this report on the social activities of the 17th Annual Meeting.)

This year's entertainment program was a memorable feature of the joint meetings of ASP–ACSM and was greatly enjoyed by the increasing number of wives who are accompanying their husbands to this annual event. Aside from meeting and greeting old friends in the corridors, the planned social activities began with the now traditional cocktail party held Monday evening. This was a

happy gathering of old friends who cordially greeted new ones. Plenty of refreshment and a background of fine music made the evening festive.

On Tuesday a delightful tea for the ladies, with Mrs. W. C. Cude, wife of the president of ASP, and Mrs. L. C. Higbee, wife of the president of ACSM, as gracious hostesses. A most entertaining program had been arranged by the committee with Brooke-Johns and his group of very unusual children who are with him on a local weekly TV program. These children, whose ages range from four to ten, dressed in colorful costumes, performed a variety of dances from hulas and acrobatics to a stately ballroom waltz. Following this amazing exhibition of juvenile talent, an ample and colorful tea table furnished refreshments dispensed by the wives of the two presidents.

Wednesday, provision was made for the ladies to go by bus from the hotel to Annapolis, where they had a very complete guided tour showing them the historic shrines of this interesting city and the Naval Academy's outstanding features. They lunched at Carvel Hall, a delightful old inn, famous for its cuisine as well as its background of tradition.

On Wednesday evening came the real gala event of this gathering of the two societies, the annual banquet with its fine food, fellowship, and topflight entertainment. This year the buffet, for which the Shoreham is known, was tried. There was a vast display of food designed to appeal to the eye as well as the taste. The heaping plates that were borne away by the diners attested to the fact that the array was tempting.

Fine music by Jack Morton's orchestra was furnished throughout the dinner and added to its gaiety, while the floor show which followed delighted and surprised everyone. It is seldom that such high-rating TV personalities are available for local affairs, but the committee was able to secure Jack Russell, performer on Sid Caesar's Show of Shows and on Omnibus, who thrilled the crowed with his wonderful voice and generous use of it. A local tap dancer opened the program and graciously acted as M.C., though out of breath from her fast-stepping performance. Another national network artist, Alan Black, delighted the audience with his exceptional harmonica playing. Mr. Black has lately appeared on Ed Sullivan's show. Magicians are known for spectacular acts, but Delage and Shirley put on one of the most mystifying and fastest performaces ever witnessed on a local stage.

Thursday afternoon, transportation was made available to take the ladies from the hotel to a beautiful display at the National Guard Armory—The Annual Flower and Garden Show. There they saw many dramatic effects amid the fairyland of blossoms; a Seminole Indian exhibit, alligators and other wild animals, tall yellow-blossomed acacia trees, and the spectacle of the colorful "dancing waters."

The final event planned by the committee on social activities was the ASP–ACSM dance on Friday evening, which was largely attended in spite of the fact that many out-of-town members had left at the conclusion of the sessions. The music was excellent, and the lovely bouffant dresses of the ladies made a second Flower Show of the Terrace Banquet Room. Door prizes were awarded, refreshment tables were made available, and the whole affair made a fitting finale to another annual series of worthwhile meetings.

Business Meeting

The Seventeenth Annual Business Meeting was held Friday, March 8, at 4 p.m., immediately following the close of the Plenary Session. President Higbee opened the meeting with a word of welcome to the representatives from other countries. He then called on Executive Secretary Walter S. Dix.

Mr. Dix asked Captain Frank S. Borden for the report of the Membership Committee. Captain Borden stated that the number of individual memberships in the Congress is 4,170 and library memberships 590, making a total of 4,760. The Northern California Section was probably the most active during the past year. The five States or areas having the largest membership are California with 708, Texas with 360, Dis-

trict of Columbia with 310, New York with 289, and Virginia with 271.

Captain Borden presented citations to three members of the Congress who had been especially active in obtaining new members. They were William A. Angeloni, San Francisco; Ralph E. Dale, St. Louis; and Ernest J. Parkin, Washington.

Major Richard T. Evans, Treasurer, submitted the financial report for the year which closed December 31, 1956. A copy of this report appeared in the January–March 1957 issue of SURVEYING AND MAPPING.

President Higbee called on the membership of the Congress to express their appreciation for the services of Major Evans, who has retired from his position as Treasurer of ACSM. Captain Henry W. Hemple, who has been appointed Treasurer, gave a brief report on the finances for the first part of 1957.

A. C. Kalbfleisch, Chairman of the Tellers' Committee, reported the election of the following officers and directors:

President—Robert H. Lyddan

Vice President—Willfred B. Williams

Directors, 1957–58 (two-year term)

Loren A. Bloom
Warren C. Crump
Charles H. Davey
Robert C. Eller
I. E. Rittenburg

In closing the business meeting Mr. Higbee expressed his appreciation for the help of all the members of the Congress who had assisted him during his term of office. He then introduced Robert H. Lyddan, who extended a word of greeting to the members present.

George D. Whitmore, Honorary Chairman, then formally closed the Seventeenth Annual Meeting of the American Congress on Surveying and Mapping.

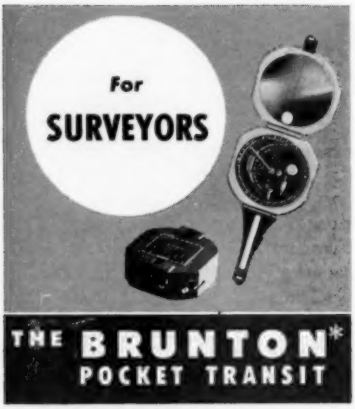
Charts of the U. S. Lake Survey

An urgent need for navigation charts of the Great Lakes became evident early in the last century when thousands of settlers migrated westward by way of the Great Lakes water route. Recognizing the growing importance of establishing safe sailing courses through the lakes, the Congress of the United States on March 3, 1841, appropriated $15,000 for a "Hydrographical Survey of the Northern and Northwestern Lakes," and assigned the project to the Corps of Topographical Engineers, which organized the U. S. Lake Survey for the purpose of making the survey. A few years later the Corps of Topographical Engineers was incorporated with the Corps of Engineers, and the Lake Survey became a part of the latter organization.

As rapidly as the surveys were made, the charts were compiled and issued. The first charts, which covered the western end of Lake Erie, were published in 1852. By 1882 the original surveys of American waters were completed, and the first series of 76 Great Lakes charts had been issued. Since the deepest draft boats on the lakes at that time required but 12 feet of water, the surveys covered depths only to 18 feet, which was considered sufficient insofar as foreseeable future developments of shipping were concerned. With the rapid development of manufacturing communities around the lakes and of the shipping industry itself, it soon became evident not only that charts had to be kept up-to-date, but also that charting in detail to just 18 feet was inadequate. As a consequence, surveys were resumed in 1901.

From these early beginnings the present series of 114 lake charts evolved, covering approximately 61,000 square miles of United States waters and 5,500 miles of United States coastline. The charts are all on the polyconic projection, and are printed in five or more colors by modern offset methods. Scales are various depending upon the purpose for which the particular chart is intended. The smallest scale chart is the general chart covering all the charted waters to a scale of 1: 1,200,000. This is not particularly useful as a navigation chart, but is intended more as a regional chart for planning and general information. Next in size are the general charts of the individual lakes at scales of 1: 400,000 and 1: 500,000 which are intended for the over-all navigation of the lakes. Then comes the coast charts, at scales of 1: 80,000 or 1: 120,000, on which it is possible to show many more details of the coastline and the hazards to be avoided than on the general charts. They are used principally when vessels are navigating close to shore. For use in the more exacting requirements of river travel and

(*Continued on page 216*)



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Surveying the New Highway Program

By C. D. CURTISS

COMMISSIONER OF PUBLIC ROADS

THERE ARE MANY reasons why I welcome the opportunity to address this 17th Annual Meeting of the American Congress on Surveying and Mapping. I am in very good company, the occasion is most auspicious, and we have certain objectives and purposes in common which lend historic importance to this gathering.

I refer, of course, to the nationwide implications of the Federal-Aid Highway Act of 1956. Even a cursory glance at the program for your meeting indicates clearly that this organization is well aware of the broad new horizons that lie ahead. In my opinion, when historians map the progress of highway transportation in the United States they will set a major milestone to mark the passage of the 1956 Act.

This far-reaching and many-sided Act not only launched the greatest public works program ever undertaken, it introduced a new concept, a new approach in highway legislation. This completely bipartisan bill, enacted during an election year, is a tribute to all who had a part in shaping it—the Congress, President Eisenhower whose urgent call for a "Grand Plan" gave initial purpose and direction to the great undertaking, and the many organizations and individuals who rallied to the support of this bold new concept.

Like most great undertakings, the new highway program is the product of many minds and has its roots deep in past experience. Since early in the century Federal legislation has attempted to deal with highway transportation and the ever-increasing importance of motor vehicles. Beginning in 1916, several major enactments have charted the course of Federal-State relations in road-building and highway improvement. This very solid foundation has stood the test of time and today it is an outstanding example of Governmental cooperation.

Here are the basic principles which have guided this partnership through the years:

Cooperation with State highway departments.

Initiative in the selection of systems, route locations, and projects for improvement rests with the States.

State highway departments make the surveys, prepare plans, let contracts, and supervise construction, subject to approval by the Bureau of Public Roads.

States maintain at State expense highways constructed with Federal aid.

State funds are required to match Federal funds. Normal matching is 50-50, with a sliding scale in the West where there are large areas of public lands.

Federal-aid funds are apportioned among the States under formulas, stated in the law, involving the factors of area, population, and mileage of rural delivery and star mail routes.

Following an apportionment among the States, Federal-aid funds are available on specific projects. As a first step, the State highway departments submit a program of projects. This program contains a brief description of projects showing the location, miles, estimated total cost, Federal aid requested, and other pertinent information. Formerly this material was reviewed by our district engineer and forwarded to Washington for approval. Under recent streamlining procedures designed to speed up the program, projects can now be approved by the Bureau's district engineers. We have a district office in each State and ten regional offices—including Alaska.

The State highway departments make the field surveys; prepare the detailed plans, specifications, and estimates; let the construction contracts; and supervise construction—all subject to inspection, concurrence,

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and approval of the district engineer of the Bureau of Public Roads. This procedure has been developed over the years, it is working satisfactorily, and is being continued in the new program.

We shall need this fine background of experience and accomplishment to carry out the gigantic task that lies ahead.

Both the magnitude and purpose of the 1956 Act are revolutionary. It authorizes a total of nearly 25 billion dollars of Federal funds to construct a National System of Interstate and Defense Highways. This huge sum, plus about 2.6 billion dollars in matching funds from the States, will provide for a 13-year construction and improvement program designed to modernize a 40,000-mile network connecting 90 percent of all cities above 50,000 population and linking business and industrial centers from coast to coast and border to border.

Therein lies the real significance of the 1956 Act. For the first time Federal legislation seeks to equate the motor vehicle with our changing, highway-urbanized way of life. For the first time we have set out to provide a complete nationwide highway network built to standards which reckon with future traffic demands. We are looking ahead to 1975 when more than 100 million cars, trucks, and buses are anticipated, compared to the 65 million in use today.

For the first time we have Federal highway legislation which clearly recognizes that motor vehicle transportation affects the lives of every American; that it influences the growth and development of countless communities. The location and design of these new superhighways will largely determine the location of new industrial sites, commercial centers, and residential areas. They will contribute to many other community services, both private and public. They will add mightily to our potential for defense and survival.

Thus you who are engaged in making control surveys and the many intricate tasks that mapping work involves are not merely furnishing essential and basic information, you also are establishing permanent monuments for a new system of highway transportation.

The public is not aware of it, but in a very real sense you are responding to a nationwide desire to known "where we are." In the process, of course, you will help to assure that the engineering and right-of-way surveys needed to locate these essential traffic arteries are sufficiently accurate, properly preserved, and tied to the network of basic ground control surveys.

Since other speakers will discuss the more technical aspects of your contribution to the highway program, let me stress other features, some of which are still a subject of misunderstanding or controversy.

One of the most important features is planned access control for all routes on the vital Interstate System. To many highway users this phrase implies an unwelcome, more or less arbitrary restriction on the free flow of traffic. Actually, the reverse is true. Long experience has shown that random access on heavily traveled routes has an inevitable train of consequences—it spells rapid obsolescence, paralyzing traffic congestion, and a mounting toll of accidents and fatalities.

Highway officials and traffic engineers, as well as those motorists who frequently use access-controlled highways, know these facts.

To these experienced observers the safety and convenience of our modern expressways is decisive. Traffic engineers can point to many studies which show that controlled access reduces traffic accidents by about two-thirds. The Automotive Safety Foundation has estimated that modernization of the Interstate System alone will save more than 3,500 lives a year.

Measured in distance this key network includes only about 1.2 percent of our total road and street mileage, but it is estimated that when completed it will carry 20 percent of all traffic. By contrast with today's costly, dangerous congestion, this traffic will move at expressway speeds. It will flow into and around large cities over safe, divided highways of 4 to 8 lanes, protected by carefully planned access. Equally important, these great trunk lines will serve the smaller communities, both directly and through interconnecting routes. This Interstate System

also will bring town and country much closer together.

Quite naturally the dramatic scope and urgency of the Interstate program have focused public attention on this phase of this 1956 Act. But this does not mean that the regular or ABC program, as we call it, has been neglected. Quite the contrary. This long-established improvement program was very materially increased by the 1956 Act. In the first nine years following the end of World War II, the regular Federal-aid highway authorizations averaged 500 million dollars per year. By contrast the ABC authorization for the fiscal year 1957 came to 825 million dollars. This is increased to 850 million dollars in 1958 and 875 million dollars for the fiscal year 1959. These increases, coupled with the fact that in the past a considerable portion of the ABC funds actually were spent on the Interstate System, make the above figures all the more effective in enlarging the program. ABC funds are divided as follows:

45 percent for the primary system,
30 percent for the secondary system, and
25 percent for extensions of these two systems in urban areas.

Ours is a big country. Witness the fact that the primary system, which embraces our main-traveled highways and includees the 40,000-mile Interstate System, is about 235,000 miles in extent. The secondary system, mostly farm-to-market roads, consists of 520,000 miles, making a total mileage of 755,000 eligible for Federal aid.

All in all, the highway act of 1956 will make more Federal-aid funds available in the first four years of the new program than in the preceding 40 years.

There is no need to tell this audience what such figures mean in terms of technical and engineering demands. They will be enormous. And the supply of qualified manpower is definitely limited.

This shortage, and it is very real, constitutes the greatest potential roadblock to the vast new program, particularly where the Interstate System is concerned. To complete this system on schedule, as the 1956 Act calls for, our State highway departments will need all the efficiency, skill, and ingenuity at their command to produce the even flow of plans and designs that are essential to keep the new program moving on schedule. If this flow is interrupted or diminished here and there, these omissions will show up as gaps in the vital Interstate System when the 13-year period set by Congress is ended.

Thirteen years may seem like a long time —until we measure it against the work which must be done and the need to accelerate our pace from now on. Moreover, Congress and the entire Nation will be watching our rate of progress very closely. There will be no opportunity to make up for lost time in the years ahead.

So far we have made a good start. During the first eight months after passage of the 1956 Act, contracts advertised and funds obligated totaled more than 1.4 billion dollars for Federal-aid primary, secondary, urban, and Interstate System highways. On the latter system alone, contracts aggregating 441 million dollars in total cost were awarded for the improvement of over 791 miles of these basic and urgently needed routes. By March 1, 1957, 8 States had committed all of their 1957 Interstate funds and were beginning to use the Interstate money apportioned for the fiscal year ending June 30, 1958.

But this impressive start leaves no room for complacency. For one thing, many States had drawn on a backlog of projects which were already planned. Advance design and engineering work had been done well ahead of time, when manpower needs were less pressing.

Both the Bureau of Public Roads and the State highway departments are fully aware of the danger inherent in the shortage of engineering manpower, and we have taken important steps to overcome it. The use of photogrammetry and electronic computers in highway design is increasing, and the best practices of each State have been made known to other States through a series of regional meetings. Such meetings were held in Chicago, Albany, Atlanta, and, this week, in Los Angeles.

Photogrammetric survey methods, short-cut ways of reproducing and consolidating bridge and highway construction methods as they fit into the pattern of mass engineering production with the aid of electronic computers, were stressed at these meetings.

As William T. Pryor of the Bureau will point out in one of your subsequent programs, map making and road building go together, and the first system of State plane coordinates was established by the Coast and Geodetic Survey in 1933 at the request of a State highway engineer for control of highway surveys on a plane-coordinate basis.

Back in the middle thirties, when the Bureau and the States launched their highway planning surveys, we were the first to ever map the United States on a scale large enough to produce a working map.

For many years the Bureau has published a highway wall map showing the U. S. Numbered Highways and the Federal-aid highway system. As you know, this was printed on the Land Management base map which is at a scale of 1 inch equals 37 miles. A new Bureau wall map will be published about the middle of the year. On this issue the Interstate Highway System will be shown in a separate color.

The Geological Survey is now compiling a new U. S. map with 17 plates showing a great variety of information. The Bureau expects to use this base in future years so that a much wider selection of supplementary information can be shown.

As the new highway program unfolds the preservation of goedetic markers will require further cooperative efforts. Though much of the Interstate System will be on new location, many miles of existing highways will be widened and reconstructed. This will endanger present geodetic markers, especially leveling bench marks, which are set within the highway right-of-way. The Bureau of Public Roads is now working with mapping agencies to establish procedures whereby these markers may be moved in such a way that the survey data will be preserved.

The Federal-Aid Highway Act of 1956 cemented the already close relationship between highway engineering and construction, and surveying and mapmaking. This is done in Section 119 by adding the establishment of geodetic markers to the term "construction," and in Section 121 by authorizing the use of photogrammetric methods in mapping and utilization of commercial enterprise for such services. Such recognitions are a long-sought-for goal and the American Congress on Surveying and Mapping is certainly to be congratulated for its part in this attainment. Equally important is the fact that the new law provides Federal funds for basic geodetic control surveys.

I know what a source of satisfaction these steps must be to all who have pointed out the value of control surveys and photogrammetry, and the immense contribution they can make to the new highway program.

Other speakers will enlarge on this topic, but let me set it in a somewhat different perspective. Again I have in mind the all-pervasive role of highway transportation in furthering the broad aims of a freedom-loving people.

Of course, we are concerned to locate, design, and build safer and more efficient highways. Of course, we are determined to use all the engineering skills and all the technical and mechanical improvements that are available to us—and they are absolutely essential. But beyond these engineering goals, beyond the complex structures, the interchanges, the bridges, and the many miles of pavement, our real objective is a better way of life for all Americans.

We are engaged in a great cooperative effort. The measure of our opportunity is also the measure of our responsibility.

IT IS NOT TOO EARLY TO BEGIN PLANNING

TO ATTEND THE 1958 MEETINGS

The Part of Control Surveys in the President's Road Program

By WILLIAM T. PRYOR

CHIEF OF AERIAL SURVEYS, BUREAU OF PUBLIC ROADS

MEMBERS of the American Congress on Surveying and Mapping, fellow engineers, and guests, I deem it a distinct privilege and honor to have been requested to present a paper, "The Part of Control Surveys in the President's Road Program," to such a distinguished group. In doing so, I hope to give something of benefit and interest to each of you.

In his talk yesterday, Mr. C. D. Curtiss, Commissioner of Public Roads, outlined many of the aspects of the Highway Act of 1956, stressed its important features, and told what it means to this country.

Today it is fitting that we specially consider control surveys in the President's Highway Program which this Act put into effect. Before doing this, however, let us review some of the events which preceded and eventually led to full acceptance of the utility and importance of control surveys in highway engineering.

We all know our country has a remarkable background of achievement. It was begun with cooperation and willingness to pay the price—whatever it might be—for achieving our objectives. And, down through the years, despite some differences, this spirit has continued and been intensified. Whenever differences occurred they were over "means" and not over "purposes" —over "methods" and not over "needs." At all times, the "purpose" has been to fulfill "needs" with consistency, continuity, and order. We, today, also feel the urgency to do this.

After the advent of the automobile, there came a slogan somewhat like this—"Let's get America out of the mud." The people wanted something better than "dirt roads." In time, came the first Federal-Aid Law in 1916 which initiated a whole succession of Federal-Aid laws, each progressively written to unify our endeavors and provide funds for highway construction. By 1921 the Federal-Aid Acts had put into effect a partnership between the Federal and State governments which has become the pattern for highway construction on a continuing cooperative basis.

As we come into the present, we realize that in spite of all that has been accomplished in this combined cooperative effort, we have failed to keep pace with our highway needs—needs resulting from our expanding economy and an ever-increasing number of motor vehicles manufactured, bought, and used on our highways year after year.

Of all our needs today, there is none greater than the need for correct and ample information. Second in importance is the need for knowledge of what should be done with this information for our common and individual good and progressive development. Briefly, we need to know "where we are," "what we should do," and "the direction in which we ought to go." These are continuing and growing needs. Fulfilling them on a continuing basis is among our constant objectives. The President's Road Program is a step toward fulfillment of such needs. It is, in essence, the "Grand Plan" which President Eisenhower outlined in his urgent message to the Conference of Governors in 1954.

To get this program under way, the Highway Act of 1956 stipulates an expanded program for construction of the primary and secondary highway systems and their extensions within urban areas and for the National System of Interstate and De-

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fense Highways. It sets forth another whole-hearted effort—with a price on it—based on correct information as to "what we should do," and "the direction in which we ought to go" "from where we are" to achieve progressive development for our common and individual good. We can now proceed on a carefully planned, long range basis tailored to fulfill future as well as present traffic needs. Ideally, the parts and the whole may be considered while working with consistency, continuity, and order to achieve all that is contemplated. In addition, the piecemeal approach and its costly inefficiency and ineffectiveness are eliminated.

Simultaneously with the many who have been working to get this expanded highway construction program under way, others equally as conscientious have been working cooperatively in another way for our common and individual good. They have been working to assure that the engineering and rights-of-way surveys made to bring new highways into being are accurate, preserved, and tied to the National network of basic ground-control surveys. All of the reasons for this are too numerous to mention now. The most obvious reason, however, is to make sure that surveys made for highways will serve everyone indefinitely in every way possible rather than merely once for the engineering of highways and the procurement of rights-of-way for such highways.

Early in highway construction on a National basis some engineers realized the need for a basic coordinated system of control surveys. And eventually, as the result of a request made in 1933 by a State highway engineer, the United States Coast and Geodetic Survey established in that year the first of the systems of State Plane Coordinates, positioned by its first- and second-order control surveys. This start was soon followed by the establishment of similar systems for each State. Many States have now adopted these systems by legislative act. The Coast and Geodetic Survey has made available the X and Y plane coordinates in the applicable State system of each control-survey monument and marker for which it has determined an adjusted geodetic position.

Through the years since establishment of these systems of plane coordinates, their use has not been as extensive as desirable. There are many reasons for this, none of which, for the common good in the long run, are fully justifiable. Knowing that reasons for every nonuse had to be overcome, many engineers have been working to remove such obstacles. And in this, the American Congress on Surveying and Mapping has been among the leaders.

During its fourteenth annual meeting in 1954, the American Congress on Surveying and Mapping passed a resolution requesting the cooperation of the Bureau of Public Roads in urging that all preliminary and location surveys under Federal jurisdiction be fully tied to the basic control-survey points of the respectively applicable system of State plane coordinates. Reasons for this were to make highway surveys serve as an extension of the Federal network of basic ground-control surveys and help eliminate the wastefulness which occurs wherever a survey is open-ended, is limited to a single purpose, and is not properly preserved for future use.

This resolution went further. It requested the Bureau of Public Roads and the States to make their surveys sufficiently accurate to fulfill such purposes, and to set survey station markers and bench marks at one-mile or smaller intervals along each highway surveyed and constructed in the future. This request was made to assure that survey position, horizontal and vertical, and the whole highway survey will be permanently preserved.

Then it continued by urging the Coast and Geodetic Survey to make adequate ties to the station markers and bench marks of all highway surveys wherever such surveys precede the extension of the Federal network of ground-control surveys. And finally, it recommended that all Federal, State, and County highway departments and commissions, all local authorities, officials and engineers, and registered surveyors

be requested to consult with the Coast and Geodetic Survey on procedures and methods of accomplishing, in the most economical and reliable manner, the mutually beneficial objectives mentioned in the resolutions.

The Commissioner of Public Roads accepted the motives and suggestions of this resolution. Accordingly, he advised the various State highway departments regarding the validity and value of putting into practice its enunciated principles and recommendations. Also, the Construction Committee of the American Association of State Highway Officials was informed of the support that the Bureau gave to the intent of the resolution.

During its fifteenth annual meeting in 1955, this spirit of leadership was continued by the American Congress on Surveying and Mapping.

The Control Surveys Division recommended a resolution that the Director of the U. S. Coast and Geodetic Survey be requested to establish along the proposed routes of the National System of Interstate Highways, at intervals of one to two miles, permanent monuments resulting from horizontal- and vertical-control surveys of at least second-order accuracy with appropriate azimuths; that the surveys be completed in advance of all construction where possible; and that the Commissioner of Public Roads be requested to ask responsible highway officials of all States concerned to connect all engineering and right-of-way surveys to these monuments and to furnish the data resulting from the establishment of any additional permanent monuments to the Coast and Geodetic Survey so that results might be incorporated into the Federal networks of basic horizontal and vertical control, reduced to State plane coordinates and sea-level elevations, respectively. In that way, they would be available for future use by local, State, or Federal engineers, and all others who could derive benefit by using them.

At the same meeting, the Property Surveys Division recommended two resolutions pertaining to the same subject.

The first of the two expressed appreciation to the Commissioner of Public Roads and the American Association of State Highway Officials for their cooperation and support of the aims of the 1954 resolution, and the steps taken to get the State highway departments to expedite the adoption of the principles of the resolution.

In its second resolution, the Property Surveys Division made prophetic history. It recommended informing the responsible officials of the Executive Branch of the Federal government, various State highway departments, and all others who may be directly affected by the action of the Congress of the United States for the engineering and construction of the National System of Interstate Highways, that the bill therefor should contain a proviso that the surveys for this system of highways should be tied to the established network of control surveys so that such highway surveys will become an integral part of the network.

Fortunately, and as desired and worked for, the Highway Act of 1956 added some vitally important provisions to Federal-Aid Law—provisions which are a legal endorsement of the "direction" long advocated in which engineering surveys should be planned and made. The 1956 Act, however, has not changed the prerogative of the States to initiate projects, make surveys, design locations and prepare plans, acquire rights-of-way, write specifications, let contracts, and supervise construction. Neither has it altered, under the Secretary of Commerce, the responsibility of the Bureau of Public Roads to provide general guidance and supervision. The new provisions in which the American Congress on Surveying and Mapping, the American Society of Photogrammetry, and all other like-minded groups have much more specific interest than many other segments of our population are contained in Sections 119 and 121 of the Act.

Section 119 amends the Federal-Aid-Law definition of the term "construction" to include THE ESTABLISHMENT OF TEMPORARY AND PERMANENT GEODETIC MARKERS IN ACCORDANCE WITH SPECIFICATIONS OF

THE COAST AND GEODETIC SURVEY IN THE DEPARTMENT OF COMMERCE. To have control surveys so recognized is one of the long-visualized, hoped-for, and worked-for goals. Thus, they are accepted as an integral part of surveying and mapping for highway location, design, and preparation of construction plans.

Now we may devote our efforts toward making control surveys fully serve the highway engineering profession. The law makes this easier by providing funds for these surveys. Statewide highway planning survey funds can be used to the extent there is an excess of such funds over those needed for a normal program of engineering and economic investigations. And more important, all classes of Federal-Aid funds, secondary, primary, urban, and interstate, apportioned to the States for highways can all be used for such surveys on a planned and approved basis. All funds used for control surveys are matched by the States in the usual proportions as stipulated in the Federal-Aid laws. Thus sufficient funds are assured.

Section 121 provides that ". . . *the Secretary of Commerce may, wherever practicable, authorize the use of photogrammetric methods in mapping, and the utilization of commercial enterprise for such services.*"

Thus, the natural union of two important elements for accomplishing topographic, land-use, and other surveys required for designing highway locations and preparing highway construction plans has been acknowledged by law. The procedural units are now fully recognized and brought together. This is the culmination of another goal which has been sought for so long by the farsighted, who are always extending our horizons. And the sequel to this is that not only has the Secretary of Commerce, through the Bureau of Public Roads, authorized what the law gives him authority to do, but he has encouraged, and continues to encourage, the States to make every possible use of photogrammetric methods in all stages of highway engineering.

We all know that mapping by photogrammetric methods cannot be done without adequate horizontal and vertical control. This is especially true for preliminary surveys by photogrammetric methods and for elimination of loose-ended p-line surveys.

Thus, basic control surveys are among the first tasks to be completed in accomplishing the large-scale mapping essential in all preliminary surveys for the location and design of highways. This means basic control surveys must be made along the route of each highway-to-be, whether it is along an existing road or on new location.

We also all know that a large percentage of the horizontal-control points established in the present network of control surveys are far from most of our present and possible highways—an essential situation during the first establishment and extension of this network from coast to coast and border to border along the best lines of sight afforded by the topography. Consequently, triangulation monuments and station markers are usually in the least accessible places and often the highest. To get accurate points of survey control near and along our highways, and routes for new highways, means that surveying to establish such points must begin and close on the widely dispersed points of the present network of control surveys.

As one of its administrative steps to get this control surveying under way within the States and do it in accordance with the provisions of the Highway Act of 1956, the Bureau of Public Roads prepared instructions for the performance of basic control surveys to establish accurate and permanent geodetic markers to benefit highway development. These instructions will be accompanied with a statement of the objectives of the Coast and Geodetic Survey in fulfilling its responsibilities for making control surveys along the routes of the system of interstate and defense highways and other highway systems. Program and project procedures established by the instructions contemplate that such basic control surveys will be made first for the interstate system of highways. This will be done by the Coast and Geodetic Survey in cooperation with the various State highway departments. The States will initiate the con-

trol survey projects. Details for each project, and an agreement therefor, will be worked out among representatives of each State concerned, the Coast and Geodetic Survey, and the Bureau of Public Roads. It is contemplated that these control surveys will not be undertaken in projects shorter than 40 highway-route miles. And ordinarily, it is expected the present and most important requirements of State highway departments will be met by establishing horizontal-control markers at spacings of two to five miles and vertical-control markers at a spacing of one mile along the interstate routes.

Wherever topographic conditions or unavoidable circumstances cause the initially set geodetic markers to be within what later becomes the highway construction limits or to be at places not readily accessible from the highway for which they were surveyed, supplemental control survey projects may be initiated and approved: (1) For moving the markers which would be disturbed or destroyed by construction, and (2) for establishing additional markers to serve wherever the initially established markers are inaccessible from the new highway. The one specific requirement is that these moved and newly established markers must be placed in accessible and permanent places near or within the highway right-of-way where their use would not cause traffic hazards. Thus, the basic control surveys to set geodetic markers along the various systems of highways will be an extension of the National network of control surveys.

We are now at the point where it is proper to mention both effect and value of control surveys in the President's Road Program, as effect and value are companions not easily separated.

Much of the System of Interstate and Defense Highways with its carefully planned places of access will be on new location—away from the present highways. This is especially true wherever the standards of present highways cannot be improved at reasonable cost and wherever land use is intense and land values are high. Such situations are more prevalent on projects of present road improvement in urban areas where widening rights-of-way, eliminating intersections at grade, and limiting places of access will be very difficult, if not impossible. Thus, many miles of new right-of-way will be required. And for most of the remainer, which will be along highways now in use, the existing right-of-way will have to be widened.

Acquiring ample right-of-way well in advance for this vast 40,000-mile system of multilane highways is one of the first major tasks, once alternate locations have been designed, compared, and the best one determined. And such acquisition cannot be attained unless deed descriptions of parcels of land constituting the rights-of-way can be written well in advance of centerline-staking of the location on the ground for each highway's construction. Accurate determination of ownership lines when preliminary surveys are being made for design of the location, preparation of construction plans, and description of rights-of-way will thus be one of the essential elements of the engineering and cadastral surveys for these highways.

Another equally important element will be the attainment of continuity throughout each description and from one description to another for all parcels of land constituting the right-of-way of every new highway and essential right-of-way widening for improvement of existing highways. Herein lies another vital service of a system of survey controls which is accurate, accessible, and close to these highways. Thus, each parcel of land required can be accurately described by position in relation to the permanently monumented station markers which are set within the National network of control surveys and its extension along each system of highways, and especially the entire system of interstate and defense highways.

It is probable that the number of control-survey projects initiated by the States may exceed the performance capacity of the Coast and Geodetic Survey. Should this occur, other projects required could be done under its administrative supervision

and guidance: (1) By the States or (2) by contract as the preliminary surveys are made by photogrammetric methods for highway location and design purposes—the one vitally important requirement being that the accuracy of such surveys would have to comply with specifications of the Coast and Geodetic Survey, which requirements are ample for all highway engineering purposes. And when this is done, both the States and firms of commercial enterprise employed by negotiated contract will gain training and experience through performance in making control surveys. In this way, the combined abilities of our surveying and engineering forces may be used wisely while our capacity to perform essential work is increased, and the accelerated program of plan preparation for highway construction will be more easily accomplished. Repetition will be eliminated, and project control surveys will not have to be run in closed circuits to ascertain their accuracy. Consequently, throughout all of the essential surveying and engineering for our highways, consistency, continuity, and order will be attained. The cost of highway surveys will be reduced, especially those made by photogrammetric methods, because the basic control will be immediately available for each preliminary survey project. Equally important, if not more so, highway engineering manpower will be relieved of the routine surveying tasks so that it can be fully utilized on design, preparation of plans, and construction engineering.

The making of control surveys along highways and the monumentation of their station markers and bench marks will not only extend the National network of control surveys, but it will preserve highway survey positions, will enable platting of all highway surveys on an accurately correlated base, and will make highway survey data readily accessible for use in making surveys from time to time as required for highway and other engineering, and for cartographic and cadastral purposes.

With such sufficiently accurate control close by and readily accessible, there will not be any need for long traverses or triangulations, or both, in making origin and closure ties for future highway and other surveys. Such a situation will have a continuing effect; all surveys made in the future should be more accurate and cost less than they otherwise would. Thus greater economy will be realized in the expenditure of Federal, State, and other highway-engineering funds.

All basic horizontal-control surveys, made and computed to apply in the applicable system of State plane coordinates, can be easily adjusted for scale and from sea-level datum at the average elevation of the highway-survey project so that distances on the maps will agree by scale without need for correction with distances measured horizontally on the ground. Finally, basic control surveys made to Coast and Geodetic Survey standards of accuracy and used as origin and closure for both preliminary and location surveys for highway projects will up-grade the accuracy and utility of all highway surveys.

Now that Control Surveys are an integal part of the President's Road Program, the surveying and engineering required to make it a reality can all be accomplished with certainty and economy for our common and individual good by progressive development.

The American Congress on Surveying and Mapping has performed a vital service in contributing to the attainment of this favorable situation. The next task we need to perform is to get all surveys, made to stake the designed alignment on the ground for highway construction, permanently monumented and adequately tied to the National network of control surveys.

To attain, however, all that is contemplated in performance of surveys essential in the expanded highway program, opposition will have to be overcome and numerous other problems solved. Missionary work will need to be done to assure full understanding of the importance and value of control surveys in accomplishing highway-engineering work. It is a task for everyone. As from the beginning of our country's history, cooperation will be necessary.

The Coast and Geodetic Survey and the Highway Program

By CAPTAIN I. E. RITTENBURG

ASSISTANT DIRECTOR FOR ADMINISTRATION, COAST AND GEODETIC SURVEY

THE Coast and Geodetic Survey has been aware for a long time of the fact that a large number of its triangulation stations have been established in relatively inaccessible places. This was necessary in order to obtain complete coverage of areas, to provide for strength of figures and lines of sight, and to secure a certain degree of permanency of the markers. Realizing this, we have, for many years, been supplementing the main scheme by establishing stations in or near towns, near airports, on college campuses, and particularly along the main highway routes at a spacing of about four miles. In spite of these attempts to bring our horizontal control down to accessible places, we still find that it is not used by State, county, and local engineers to the extent we would like. Our level net follows railroads and highways rather closely, and for this reason and also because it is easier to extend leveling control on a local basis, our bench marks are used much more than our horizontal-control stations.

Since the Federal-Aid Highway Act of 1956 authorizes the cost of the establishment of geodetic control markers along the proposed Interstate Highway System, we look for a real opportunity of extending such control into areas not yet touched, to be used not only for large scale maps and construction surveys in connection with the highway program but also for the control of all other types of surveys, including property and engineering. A feature not to be overlooked is the fact that the geodetic monuments established in the highway program will be readily accessible to all.

Professional surveyors and engineers are becoming aware of potential benefits to them of this program. On February 9, 1957, at its Sixteenth Annual Meeting, the Michigan Society of Registered Land Surveyors adopted a resolution which states, and I quote, "The Michigan State Highway Department be requested to take advantage of this opportunity and take steps to arrange with the Coast and Geodetic Survey to observe, compute, and adjust a system of permanently marked geodetic control stations at intervals of approximately two miles along all new highway routes in the State of Michigan for which such Federal funds may be available; so that not only the property corners but also the highway construction surveys may be based on geodetic control."

A fair question might be: Can the cost of geodetic control in connection with highway construction be justified for this purpose alone? First, it should be understood that we are considering very costly modern highway construction wherein the extent and complexities of these systems require surveys of much greater accuracy than heretofore. Horizontal and vertical alignment of these highways are much more of an engineering problem than ever before. Grades and curves used on modern highways must take higher speeds into consideration. The construction of underpasses, overpasses, cloverleaf accesses, etc., requires the use of planimetric and topographic mapping on very large scales which, in turn, requires basic control surveys of an accuracy heretofore not considered necessary in highway work.

Route mapping along the proposed highways necessarily cannot be done continuously, either as to space or as to time. To assure that all the "pieces" will ultimately fit, both statewide and nationwide, it appears logical and probably necessary to

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turn to the use of the State Plane Coordinate Systems, and to the Federal Level Net based on mean sea level. It is only in this way that high accuracy over great extent and complete coordination between the many highway projects can be attained. A rough estimate for the total cost of the establishment of geodetic control per mile of highway would be of the order of one-tenth of one percent of the total highway cost.

There were probably thousands of miles of highway surveys run in the past that, figuratively, start nowhere and end nowhere. Although these surveys have served an immediate need, they bore no relationship, one to another, did not possess the accuracy nor the permanency necessary for other purposes, and their usefulness came to an end after the construction of the highway. All these deficiencies will be overcome in conducting surveys under the terms of Section 119 of the Federal-Aid Highway Act of 1956.

We are working closely with the Bureau of Public Roads in the formulation of policy and procedures in initiating and implementing control-survey projects in cooperation with the various States. It is important that the necessary accuracies be maintained and proper connections to the Federal network be made if these surveys are to perform their designated functions.

Under the policies and procedures established jointly by the Bureau of Public Roads and the Coast and Geodetic Survey the initiative must be taken by the States. The Bureau of Public Roads is ready to approve those projects which meet the established criteria. The Coast an Geodetic Survey is likewise willing to assist any State which desires to establish permanently marked geodetic control along its interstate highway routes. The assistance we offer is most flexible and will be tailored to the wishes of any State. On a cooperative basis we could do it all, furnishing all the personnel and equipment and scheduling the work to meet the State's needs to the best of our ability. Also on a cooperative basis we might furnish part of the personnel, instruments, and equipment. Further, we are prepared to furnish supervisory personnel only and let the State furnish the remainder needed in personnel, instruments, and equipment. We are prepared to cooperate fully with any State and to work out the best method of operation within the policy and budgetary limitations of that State.

Up to now we have worked out operating details with four States. In each case the State's needs were best satisfied by our furnishing a 7- to 11-man field party, all the instruments, and some of the vehicular equipment. The balance of the men and equipment was furnished by the State. We shall make the computations and furnish to the States adjusted positions on the Plane Coordinate System.

Projects are already underway in four States: Washington, Oregon, Nevada, and South Carolina.

An 85-mile project in Washington, from Ritzville to Spokane to the Idaho line, approximating U. S. Highway 10 is now about one-half completed. In Oregon, a project of about 75 miles along U. S. Highway 30 between Troutdale and The Dalles is over half done. These projects were started about the middle of October.

Some 140 miles of a route along U. S. Highway 91 centered on Las Vegas has probably passed the half-way mark at this time. The work started the middle of November. The weather on this project has been more favorable than for the two northern States.

The reconnaissance has been completed for triangulation along a 22-mile stretch of U. S. Highway 76 between Newberry and Clinton, South Carolina, and observations were commenced in late February.

All these projects will involve leveling which has been completed to some extent. The recommended spacing of horizontal-control stations along the highway routes is 2 miles and that for bench marks is 1 mile. The actual spacing is at the discretion of the States with certain limitations set by the Bureau of Public Roads.

The use of the Federal control net and the State Plane Coordinate Systems by State

highway departments has been slow in coming. Massachusetts, Connecticut, California, and Nevada are examples of States which have recognized for many years the value of high grade surveys based on the National network. Other States are following. In the past year or so we have cooperated with the States of Washington and Maryland in special highway programs.

The advent of the President's Highway Program should give a real impetus, at last, to a nationwide recognition of the need for accurate and systematically executed highway surveys. The Bureau of Public Roads definitely looks with favor upon this and is ready to take the lead. Their engineers are anxious to see that such surveys are conducted properly—and rightly so—since a large portion of the funds made available will be Federal. We, on our part, will bend every effort to aid in the program. It is the best opportunity ever offered for a valuable and extensive program of control surveying in areas accessible to all.

City Topographic Maps Proven to be Valuable Far Beyond Their Cost

"The job they're doing," says Greensboro, N. C., City Planning Director Ronald Scott, "easily would cost $200,000 if it was performed by ground surveying teams." Scott referred to a $40,000 aerial survey of Greensboro and its fringe areas by Aero Service Corporation, Philadelphia, Pa.

The first phase of the mapping operation, aerial photography of 160 square miles, was completed in the early spring of 1957. The photographs were taken from a specially outfitted Cessna 195 equipped with an $8,000 mapping camera. Each 9- by 9-inch photograph covers approximately 464 acres.

From the air photographs, 43 topographic map sheets will be prepared to cover a 27-square-mile area. This new mapping, at a 1:2,400 scale and with a 2-foot contour interval, covers fringe areas around Greensboro, including the suburban communities of Bessemer and Hamilton Lakes. The maps will be used by Greensboro city engineers to design and plot locations of water lines, storm and sanitary sewers, and other public utilities. In addition, the maps have a wide range of other uses for many city planning projects and as basic topographic information for private and industrial real estate developers.

Under this current project, the photography was extended to 160 square miles. However, only 27 square miles is being mapped immediately. The additional photography will enable topographic maps to be prepared as required. Greensboro's long experience with topographic maps at this scale and contour interval has proven the value of such projects.

Topographic maps for Greensboro, N. C., were first prepared in 1926 by the R. H. Randall & Co., Engineers, of Toledo, Ohio, who also established the basic network of Greensboro precise positions and bench marks to control that mapping and the subsequent extensions to follow. These original maps are still in use today and have proven to be valuable far beyond their cost in many situations.

The current mapping program with Aero Service Corporation is an extension of the mapping work started in 1926, but the modern method of photogrammetry is now used instead of the former planetable work by ground crews.

Two years ago a similar project was completed when "Aero" photographed some 200 square miles of the Greensboro area. Nearly 38 square miles of topographic mapping was completed under that program.

ACSM member Ronald Scott, (right) Greensboro, N. C., City Planning Director discusses last minute mapping details with aerial photographer Tom Forrest (left) and pilot H. J. Kemley of Aero Service Corporation, Philadelphia. The air mapping team last spring completed photography of about 160 square miles of Greensboro's fringe areas.

Geodesy—A Framework for Maps

By CLEMENT L. GARNER

IN THE EARLY SUMMER of 1816 in the neighborhood of Paterson, New Jersey, a seriously energetic man in his middle thirties was riding along rough country roads in a carriage, especially built to carry delicate surveying instruments not common for that time. Ferdinand Hassler, Swiss immigrant to this country in 1805, was then on his way to a nearby triangulation station to make the observations which started and eventually became a part of the vast geodetic triangulation network in the United States and in North America.

His principal and immediate objective was to develop and extend this scheme of triangulation to New York harbor and the coastal areas to the east and south as geodetic control for the hydrographic surveys essential for the production of nautical charts so necessary for the ships plying that region.

More than a century later (1932) many of the stations established by Hassler and his successors had disappeared. New work was being extended along the eastern shore of Delaware River in southern New Jersey, and it was particularly important, for purposes of survey coordination, to obtain a connection or "tie in" to one of the old stations. The station selected for the "tie in" had been reported as lost, but the description was such as to hold promise that it was still in existence. The pertinent part of the description was that the subsurface mark consisted of an old porcelain cone buried two feet below the surface and, moreover, there was no evidence of the area having been disturbed.

The Chief of Party was instructed to locate a new point nearby and determine its position, from which, of course, the distance and direction to the old station could be computed, laid off on the ground, and the old station searched for. The new point was readily selected but the property owner, one of long residence, had never heard of the old station and was very skeptical and uncooperative. It was no surprise that he did not readily consent to the erection of a steel tower in his field as necessary for the required observations. However, consent was finally obtained on condition that he would be paid for any damages to crop or property, a customary practice under such circumstances. Finally, when the time came to dig for the old station quite an audience had assembled as a result of neighborhood interest and natural curiosity. Very soon the shovels encountered some hard object, and then the porcelain cone was laid bare. An old colored man in the group shouted to the party chief "Man, you ought to get a premium." Everyone was cheered by the experience, and the property owner was so pleased he immediately said the damages could be forgotten; he was already well paid, besides he had a survey station on his land.

The point of this story is that, from a known station (position), a supposedly lost station or its precise location can be found. Thus, the replacement of any lost or destroyed marks of any survey can be accomplished, so long as such stations are coordinated into the network.

The fundamental consideration of permanency is the reason for the establishment of survey stations in the first place, the hope being that the mark or its location can be recovered even though the surface features may have been entirely obliterated. History attests to the effect of the passage of time in changing the earth's surface, of which many recent archaeological discoveries are good examples.

The geodetic framework of the country then becomes the guarantee that fixed points of any and all mapping or surveying procedures brought into coordination with the Federal network of triangulation may be retraced and any lost marks relocated as necessity may dictate. Such operations are usually associated with revision surveys, which, because of natural and manmade

changes on the earth's surface, become a part of the mapping process and over the years are necessarily continuous. This principle of position and permanency is especially important in the delineation and settlement of boundaries, riparian rights, general property surveys and an infinite variety of other engineering and scientific problems.

These same principles apply with equal force to the redetermination of evaluations as required for the solution of similar problems in science and engineering. A conspicuous example is the survey to determine the high water line on the south side of the Potomac River, the District of Columbia-Virginia boundary, in litigation until the last few years. Another is the California Tidelands case.

But we are ahead of our story. On this sesquicentennial of the Coast and Geodetic Survey it is opportune to review some of the Bureau's accomplishements in its geodetic operations and related activities during the past 150 years.

JEFFERSON SELECTS HASSLER

In 1807 Congress authorized President Jefferson to make a survey of the coast, harbors, outlying islands, and fishing grounds. While the authority preceded by about nine years the inauguration of field work, there were meanwhile the matters of obtaining instruments, equipment, and funds, and of organization; a reminder of some of the barriers to getting things done quickly, not exclusive to any time or place.

Jefferson called on the American Philosophical Society of Philadelphia, the leading scientific body of the day, for recommendations and plans to accomplish the desired surveys. The society in turn appealed to its members and among the plans submitted was one by Hassler. He was so outstanding in his scientific knowledge and attainments that he had been admitted to membership in the Society soon after immigrating to the United States from Switzerland. Hassler's broad, comprehensive plan was judged the best of those submitted, and finally led to his appointment as first head of the Coast Survey. He had been teaching mathematics at West Point.

As already related, Hassler personally conducted the first field work of the Bureau, triangulation, in the region where Paterson, N. J., now stands. This same triangulation became a part of the first large project in the United States, which extends from the Bay of Fundy southwestwardly along the Appalachian Mountains to New Orelans. This is an important section of the basic framework of the country, now known as the North American Datum of 1927. There were extensions form this long arm of triangulation to the seacoast as requisite for the control of hydrographic surveys and charting operations.

GEODETIC CONTROL FOR THE INTERIOR

In 1871 Congress authorized the extension of the geodetic control throughout the interior and to the Pacific Ocean as a means of obtaining a single coordinated system on which all surveys of the country could be based. The title of the Bureau was accordingly changed to Coast and Geodetic Survey in 1878. During this period there was increased effort in carrying the transcontinental arc of triangulation, then the longest project undertaken, from its juncture with the eastern oblique arc at the head of Chesapeake Bay along the 39th parallel of latitude to the west coast at San Francisco.

Space does not permit a full description of the evolution of the triangulation and leveling networks in the United States in their present state. However, it was inevitable that transportation would be a controlling factor. Much of it was by pack mule or ox cart and it was natural to use all available facilities and locate survey projects conveniently near them. One area was as potentially needful of the control as any other. From these factors evolved schemes of triangulation generally east and west and north and south, meshed at junctions. Boundaries, land corners and other important engineering landmarks were, where practicable, brought into coordination on general principle.

Triangulation was greatly advanced

through the development of the portable Bilby steel tower by the late Jasper S. Bilby, well known signalman who served the Bureau with distinction for many years. The use of the steel tower did away completely with the old method of building costly wooden towers and speeded up operations immeasurably. The towers may be erected to any desirable height up to 125 feet and can be transported on a single light truck.

Some 400 first-order base lines are distributed throuhout the system in order to maintain the accuracy. The early base measurements were with iced bars. Later, measurements with steel tapes were made at night to avoid excessive temperature errors. Then invar tapes permitted measurements in daylight or sunlight. Now, the geodimeter measures bases with high accuracy without any linear measurement on the ground. This instrument, developed by Bergstrand of Sweden, employs the velocity-of-light principle and results are incredibly accurate. It is interesting to recall that the late Michelson and his assistant Pease suggested this possibility to the writer during the measurement of the Pasadena Base in 1922.

A triangulation network must be held in true position and orientation throughout its entire area. For this, astronomic latitude, longitude, and azimuth observations are required at specified intervals in any basic framework of geodetic control, in order to insure that all sections of the framework can finally be referred by mathematical adjustment to the datum most nearly representing the true positions on the earth's surface. These stations number roughly latitude, 1200; longitude, 1000; and azimuth, 1400.

STATE PLANE COORDINATES

The traditional search for permanent reference is further evidenced in the transfer of land ownership from early times. Some of the early land grants and deeds are almost meaningless, some even ludicrous—to which almost any land surveyor can attest. Yet, we could have done no better with their equipment. It seems obvious that permanent reference on small scale, in the long run, is ephemeral. The truly permanent definition for position on the earth's surface is latitude and longitude. When latitude and longitude are determined for well distributed monuments over a large area, then, and then only, is permanency obtained.

But such coordinates, usually referred to as geographic or geodetic, did not appeal to land surveyors generally, for traditionally they have used the metes and bounds methods of calculating their surveys and had little or no training in making geodetic computations.

The late George F. Syme of the North Carolina State Highway Commission, an experienced land surveyor, faced the problem of obtaining some kind of comprehensive coordination between various detached right-of-way surveys for the highway commission in order that they might serve other purposes than just highway planning. About 1932, he wrote the late William Bowie asking if a practical means could not be found of holding to the old plane survey methods of computing and, at the same time, make use of the geodetic positions and azimuths. Bowie, with Dr. O. S. Adams, a leading mathematician of the Bureau and an authority on the theory of map projections, pondered this problem along with others and came up with the systems of plane coordinates for the separate states. However, in order that scale errors could be maintained within acceptable limits of 1 to 10,000, it was necessary that many states have more than one zone, Texas has five.

THE LEVEL NET

The development of the level net began in 1878 with the enlarged scope of the geodetic work, and has evolved in a manner similar to that of the triangulation, being largely influenced by the same factors of distribution and transportation. The leveling network is also adjusted into a single harmonious system which consists of about 310,000 bench marks distributed along some 400,000 miles of level lines.

It is not superfluous to say that elevations are in universal demand by all engineering works and to meet countless of our daily

needs. As evidence, the Coast and Geodetic Survey in 1955 responded to more than 20,000 requests for elevations. (There were approximately 8,000 requests for triangulation data.)

FIGURE OF THE EARTH AND ISOSTASY

Early in the century one of our own giants, John F. Hayford, made a major contribution to geodesy in determining, through long and exhaustive investigations, a new figure of the earth. In 1924, the International Union of Geodesy and Geophysics, in assembly at Madrid, adopted and recommended for world use the International Ellipsoid which is largely the product of Hayford's work and for which he was universally acclaimed. Hayford also made many investigations in isostasy. During the latter part of his work he was associated with William Bowie, who succeeded to Hayford's position. Bowie continued the investigations into isostasy with great vigor and thoroughness, was the author of *Isostasy*, and also received many honors at home and abroad for his scientific work.

COOPERATIVE PROGRAMS

Since early in this century precise triangulation and leveling have been increasingly used in studies being given to many of the geophysical sciences, e.g., the investigation of seismic crustal movement and settling of the earth from various causes. Necessarily this requires a high degree of cooperation with interested agencies in order that the results may be most effective.

An outstanding example is the program of triangulation and leveling inaugurated in California in 1922 in examining crustal changes resulting from seismic activity. Beginning with that year Congress annually appropriated limited funds for research in critical areas. The Carnegie Institution of Washington and many geologists were consulted in planning and executing the various projects.

For some years a series of investigations in earth settlement problems have been carried on in the vicinity of San Jose, near Long Beach and Terminal Island, California, and in other regions. Studies have been not only in the causes of the settlement but also in the methods of furnishing elevation data in unstable areas. Geologists say that some areas are settling because of the continual lowering of the water level, while others are subsiding because of material (petroleum) being taken out.

Other cooperative projects of far reaching significance were the measurements of the Pasadena Base (1922–23) and the Santa Ana base (1931) for the late Dr. A. A. Michelson, for use in his determination of the velocity of light, the former in the open air between mountains and the latter in a mile-long vacuum tube three feet in diameter.

Cooperation of particular international significance was the joint adoption of the North American Datum by Canada, Mexico, and the United States in 1913. This allows mapping to cross borders without troublesome discrepancies.

The cooperation extended to other countries of the Western Hemisphere in recent years has greatly stimulated international goodwill and our joint interest in all phases of mapping. Cartographic conferences inaugurated in 1943 under the auspices of the Pan American Institute of Geography and History have been held in Washington, Rio de Janeiro, Caracas, Buenos Aires, Santiago de Chile, Santo Domingo, and Mexico City.

THE FUTURE

While the status of our geodetic control is far from adequate to meet all mapping requirements, the present outlook has some bright spots. With automotive transport, an expanding highway system, and the greatly improved surveying instruments and equipment now available, it would seem that the vacant areas can be filled in expeditiously and economically, commensurate with public needs. The entire highway system should, in fact, be an integral part of the horizontal and vertical networks. Highways, roads, and railroads are easily identifiable from the air and in photographs. What a boon it would be to survey control to have their coordinates! Then any acceptable photograph could be used in the map compilation. Fortunately interest in

this matter, long encouraged by some, is now more promising. It is hoped that full understanding and cooperation among the authorities may soon avail us of this great potential to mapping.

The geodesist of the future has his work cut out on a global scale. Much of the world is still unmapped, and the extension of the necessary framework can and should be speeded up through electronic methods of determining geodetic distances. In recent years this method has been successfully used in Canada, between Florida and the Bahamas, and throughout the Caribbean area.

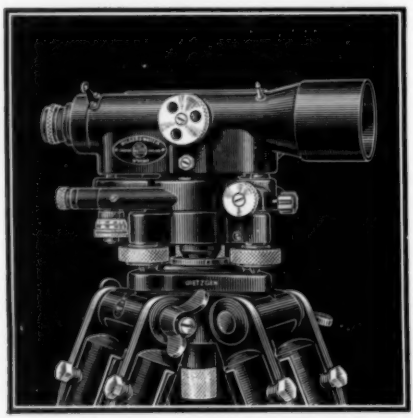
The North American Datum of 1927 was more than 100 years in the making by a rich and prosperous nation, but it should not be used as a yardstick for the future. Electronic methods of measurement provide a means of developing a datum in a relatively short period of time. South America would seem to be a most promising field for such a datum. The problems have been considered, without action, at many of the South American cartographic conferences.

CONCLUSION

If one should wonder how the results obtained by Hassler, with his 100-pound, 24-inch theodolite, and the iced bars for base measurement, compare in accuracy with these obtained by today's small, compact theodolites and the geodimeter, let him be assured that the comparison is extremely favorable. It is an everlasting tribute to Hassler's ability, vision, and integrity that he planned so well.

Aero Service Corporation

Aero Service Corporation, 210 East Courtland Street, Philadelphia 20, Pa., announces the opening of new quarters for its Washington staff at 610 Montgomery Street, Alexandria, Va.



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DIETZGEN

Interpretation of Deed Words

By CURTIS M. BROWN

Curtis M. Brown of San Diego, Calif., submitted the following short paper to the Publications Committee with the suggestion that a special department be established in SURVEYING AND MAPPING for presenting material relating to the legal elements of boundary surveys. This department could receive reviews of recent or old court cases that have established important principles of surveying law. The Publications Committee and Editor would like to know if the membership of ACSM would support such a department. This would require that you be more than readers; you must also be contributors. Mr. Brown has signified his willingness to start such a department, but the committee would not want to add this department to our Journal unless we are assured of adequate support.

—EDITOR

THE ENGLISH LANGUAGE contains many words that have dual or multiple meanings. Does the word *red* mean a color or a communist? Deeds (here meaning an instrument to convey real property, not a good deed by fellow man) are in writing. If words can mean two things, it can be expected that differences of opinion, as to a deed's intent, will develop. Thus, what does the word *North* mean? Is it *magnetic North,* is it *astronomical North,* or is it *North* relative to a line whose bearing is defined by other words in the deed? When the word *due* is used in conjunction with *North,* does *due North* mean *astronomical North,* or does it mean *North* relative to another line?

In the final analysis, the courts resolve these questions for a particular deed, and by police power they enforce their interpretation. If surveyors are to accurately transform deed terms into monuments upon the ground, it behooves them to study the meaning of deed terms as defined by the courts and to attempt to understand the court's thinking. The words *due* and *North* have been the subject of litigation and will be used to illustrate how courts arrive at their decisions.

North, as used by surveyors, has at least three meanings and possibly more. It may mean "in the direction of the earth's North Pole as determined by a star observation." It may mean "in the direction of the magnetic North Pole as determined by a magnetic compass at the spot of the deed." It may mean "in a direction that is North relative to a given bearing of a line whose direction is fixed by monuments existing on the face of the earth."

Due, as defined by Webster's Dictionary (excluding meanings not applying to surveying), is "directly; exactly; as a due-East course." As used by surveyors in the early days, especially in surveying government sectionalized land, the words *true* and *due* indicated that a magnetic-North observation, as obtained from a magnetic compass, was corrected to *astronomic North.* The purpose of the term, the differentiation between magnetic and astronomical North, is no longer needed because of the abandonment of the magnetic compass as an instrument for determining property-line directions. But title authors and surveyors have continued to use the terms *due* and *true* rather loosely, and often erroneously.

The following deed (*See* Figure 1) was the subject of a long-continued legal battle between Richfield Oil Corporation and Crawford, et al (249 P 2nd 600); "Beginning at a point on the SW line of said Rancho (Cuyama) at a 2-inch galvanized iron pipe 6-inches high in a mound of stones, with brass cap marked 'Cuyama Rancho C-No 31', set by Gerald C. Fitzgerald, Registered Civil Engineer, and shown on map recorded in Book 26, Pages 138 and 139 of Records of Surveys, Records of Santa Barbara Co.; thence N 65° 10′ 24″ West along said SW line as established by said Gerald C. Fitzgerald and shown on said Records of Survey map, a distance of 2,877.60 feet; thence due North 13,295.04 to the true pont of beginning; thence, due West 1320 feet; thence, due

North 2640 feet; thence, due East 1320 feet; thence, due South 2640 feet to the true point of beginning, and containing eighty acres, more or less." Who would think that such an innocent looking document would be the subject of expensive litigation? The trouble arose from the interpretation of the meaning of *due North*.

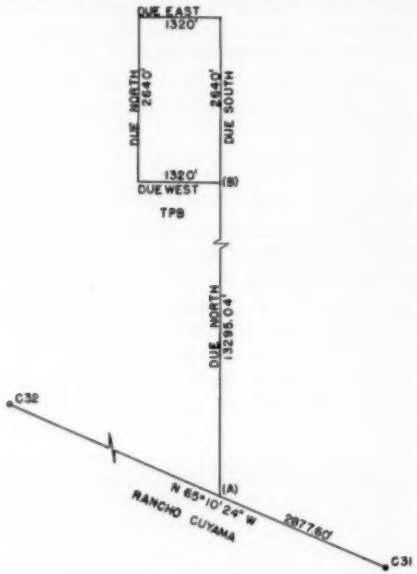

FIGURE 1.

One surveyor surveyed the legal description of the property by running the line 2877.60 feet along the boundary of the ranch to point *A* (*See* Figure 1), and then turning an angle of 65° 10′ 24″ at point *A*. The other surveyor used the same method to locate point *A*, but from that point he ran a line *due North* based upon a Polaris observation. The difference between the two methods resulted in an East-West displacement of about eleven feet at point *B*, and this difference of eleven feet placed the location of an oil well in jeopardy.

The practice of assuming that the bearing of a given monumented line of a deed is correct, and then surveying the remainder of the deed relative to the given line, has long been an accepted custom of surveyors. But in this case the court decreed that the word *due* changed the basis of bearings from "North relative to a given line" to "astronomical North" as determined by a star observation.

Does this mean that every time the word *due* is used prior to the word *North* the meaning is "astronomical North as determined by a stellar observation?" Certainly not! Only in very similar cases would it be applicable.

To be valid, a deed must be in writing. In a court trial evidence cannot be taken to exclude words from the written deed, nor can evidence be taken to include words that are not in the writings. It must be presumed that the document as written includes all of the words intended and does not omit words not written. But this does not exclude evidence taken for the purpose of explaining words that already exist within a deed. Thus, if the term *due North* is not clear in meaning, and exists in a deed, the court may take testimony from expert witnesses to explain the commonly understood meaning of the term. Such evidence is called extrinsic evidence and may be defined as evidence other than that contained in the writings. Extrinsic evidence is not accepted for the purpose of varying or contradicting the terms of the deed but to assist the court in understanding the words that already are a part of the deed.

In the above case extrinsic evidence was admitted and many surveyors and engineers testified, some taking one side and others the opposite. The weight of evidence in this particular case precipitated the decision that *due North* meant *astronomical North*. After reviewing the case carefully, the following conclusion can be stated. Except where other terms of a deed or admissible extrinsic evidence indicate another intent, a *due North* call should be interpreted to mean an astronomical bearing. An understanding of the exception is more important than understanding the definition of due North.

Two mining men disagreed upon the meaning of a deed reading in part: "running thence North 23° 15′ W, 640 feet;

thence N 45° W to Devils' Canyon (11 Cal 194)." Quoting from the case, "In an action concerning a disputed boundary between two claims, depending on an agreement between parties in which the word 'North' was used, and parol [verbal] evidence was admitted to prove that it was the custom of the locality to run boundary lines by the magnetic meridian, and that was the understanding of the parties; *Held,* that such evidence was admissible not to contradict or vary the term, but to ascertain the sense in which it was used." In a modern deed, where the compass is no longer used, the word *North* could not be *magnetic North,* but at the time of the above deed it was proper.

The courts in each of the above cases adopted that meaning for *North* and *due North* which they believed to be the intent of the parties of the deed. No fixed rule exists that says *North* is always *astronomical North.* In older deeds in some localities the word *North* means *magnetic North* for the simple reason that *magnetic North* was the intent at the time of the deed. In other localities, where surveys were made after the date of the abandonment of the magnetic compass, the word *North* is either *astronomical North* or "North relative to a defined line."

Ambiguous deed terms are interpreted in the light of the intent of the original parties by investigating; (1) The surrounding conditions existing at the time the deed was written, (2) The extrinsic evidence that explains the common meaning of the terms, and (3) The meaning of the ambiguous terms relative to all the other written words in the deed.

In the construction of the instrument, the intentions of the parties is to be pursued, if possible. "The only rule of much value—one which is frequently shadowed forth, but seldom, if ever, expressly stated in books—is to place ourselves as nearly as possible in the seats which were occupied by the parties at the time the instrument was executed; then, take it by its four corners, read it." (Walsh *v.* Hill, 38C 481.)

MORAL: If a deed is being written and *North relative to a star observation* is desired, the deed author should state *astronomical North.* If *North relative to a given line* is intended, the usage of *due North* or *true North* should be avoided. In the future, the words *due* and *true* should be restricted to the interpretation of existing records and not used in the creation of new records.

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A Note from "Down Under"

The following is copied from the *New Zealand Surveyor,* Vol. XXII, No. 1, February 1957. The "likely lad" is apparently none other than our Vice President Willfred B. Williams.

—EDITOR

Mr. W. B. Williams, of "Williams and Works," registered civil engineers and land surveyors, of Grand Rapids, Michigan, U.S.A., has recently got hold of one of our Journals from American "Survey and Mapping" in order to read Mr. Basire's article on the Alexandrian Era of Learning, which he much enjoyed, but, furthermore, "was quite astonished to see a complete report of the survey examinations given in March, 1952. Would it be possible for me to get other copies containing examination questions?"

He goes on: "Our State Board of Registration pursues the opposite plan and refuses to permit any publicity regarding their examinations, which to my mind is wrong, and I was very pleased to see that you are not pursuing that policy in New Zealand. I could go on at considerable length in commenting on your publication and the great interest I have found in it. Organizationwise the Commonwealth surveyors are far ahead of us in the States, and your Canadian brothers particularly are serving as a real inspiration to us in the American Congress on Surveying and Mapping."

Mr. Williams seems a likely lad of considerable judgment and discernment, and naturally, we have sent him some further examples of New Zealand light and wisdom.

A Formula for the Probable Error in an Inaccessible Base Resection

By ERWIN SCHMID

MATHEMATICIAN, COAST AND GEODETIC SURVEY

GIVEN the grid coordinates of two fixed points A and B, it is possible to find the position of a third point P by observing the directions from P to A, B, and an arbitrary fourth point S if the corresponding directions at S to A, B, and P are also measured. In figures 1, 2, and 3 the observed data are the angles α and β at S, measured from the line PS to A and B respectively, together with the corresponding angles γ and δ at P again measured, as indictated by the curved arrows, from the line PS to PA and PB respectively. The construction on a scale drawing, and hence the computation, of the points P and S can then be carried out simply and directly by intersecting for the so-called Collins points[1] R and Q and then drawing the lines AP and AS so as to make the observed angles γ and α with the line RQ, extended if necessary. The two circles in the diagrams, determined by the points A, B, P and A, B, S respectively, are not part of the construction but are included to indicate the motivation for the method.

The procedure, in detail, is as follows: P and S are the points whose locations are required. The angle α which the direction SP makes with the line connecting S to the fixed point A of the inaccessible base line AB is laid off at the other fixed point B and in the opposite sense initiating from BA. For example, in figure 1 angle α is counterclockwise (negative azimuth) at S, and clockwise (positive azimuth) at B. A similar construction with β at A establishes the intersection R. With γ and δ we now intersect for Q and hence have established the line RQ on which the points P

[1] G. T. McCaw, Caswell's Three Problems, *South African Survey Journal*, No. 17, May 1928.

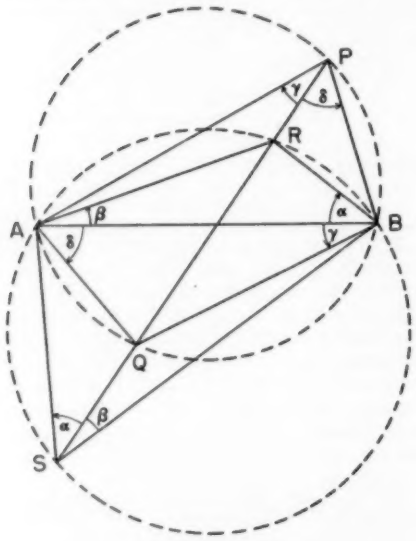

FIGURE 1.

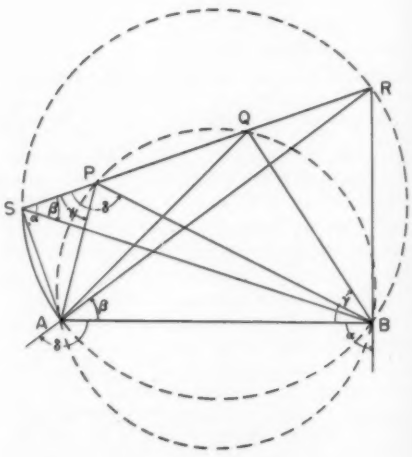

FIGURE 2.

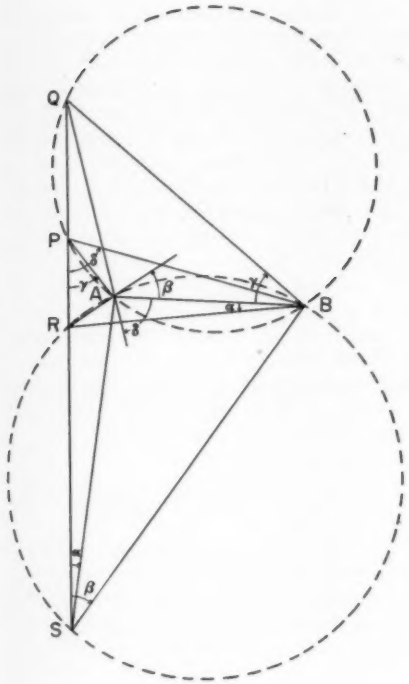

FIGURE 3.

and S must lie. Through any point of line RQ draw a line which makes the angle γ, with the observed sense, with RQ and draw a parallel to this line passing through A. This parallel will intersect RQ at P, the point sought. An analogous construction with δ establishes PB and checks the construction of P. The construction of S with α and/or β is similar in all respects.

It is apparent from the method of construction that the degree of accuracy of determination of P and S is affected by errors in the construction of the points R and Q, the azimuth of the line RQ and the strength of the cut for P from AR or BR. A qualitative inference can be made from the complete figure; any weakness in these elements will be reflected as a positional error for P (or S). The length of RQ relative to PS is obviously critical. A short length for RQ will result in a large azimuth error for the line and hence a large linear displacement for P. RQ shrinks to zero when SP passes through A or B. The azimuth of RQ is then indeterminate, as is the position of P and S. For any given position of P, therefore, the fourth point S must not lie on or near either of the lines PA or PB. This situation will be signalized by at least two of the four observed angles being near 0° or 180°. Hence, if an approximate position is assumed for one of the points, say P, this line of reasoning leads us to attempt to locate the second observation point S on one of the bisectors of the angles formed by PA and PB, these bisectors being, of course, the loci of points at a maximal distance from the "danger lines" PA and PB. When the two supplementary angles at P differ considerably in size, the bisector of the larger angle should be chosen.

Some useful conjectures concerning the strength of figure can be made along the following lines. Consider a hypothetical fixed position for the point P. This automatically fixes the corresponding Collins point Q on the circle through A, B, and P so that the angle formed by the rays from Q to A and B equals the angle APB or its supplement. Since the positional error of an intersection is proportional to $\sqrt{a^2+b^2}/\sin C$,[2] where a and b are the lengths of the intersecting rays and C the angle of intersection and since, furthermore, the error in the location of the Collins point affects the ultimate accuracy of P and S, it is at once apparent that P must subtend a good angle at the chord AB. The optimum angle would be 90° which occurs when P (and Q) lie on the circle which has AB for its diameter. For fixed C, a^2+b^2 is a minimum when Q is on the perpendicular bisector of AB. The intersection of this perpendicular bisector with the circle whose diameter is AB is therefore the strongest location for a point to be fixed by this method. The second point of observation in this strongest fix should be at the diametrically opposite point on the same circle.

[2] Jordan-Eggert, Handbuch der Vermessungskunde, Vol. 2, 10th ed., Par. 99.

There is no danger circle as in the case of the three point fix. All four points may lie on the same circle and will produce an accurate fix provided that at the same time we avoid:

1. Having the line PS cross AB near A or B, since this makes RQ small.

2. Having the points P and S too close together, since this causes a corresponding close approach of the Collins points R and Q.

3. Placing either P or S near the line AB or its extension, since the chord AB will then subtend an angle near 0° or 180° which means that the corresponding Collins point will have a large error.

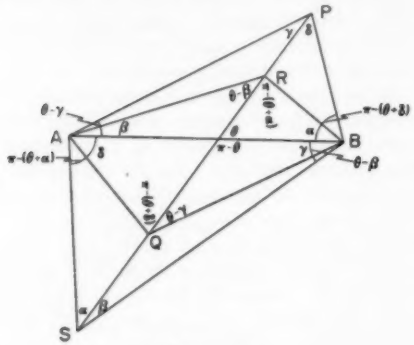

FIGURE 4.

It is of interest to note that when all four points lie on one circle, P is the Collins point of S, and vice versa.

We proceed to the development of a quantitative formula for the probable error of displacement of points resected by this method, subject to probable errors ϵ_α, ϵ_β, ϵ_γ, and ϵ_δ in the observation of the four required angles. The result is general but in order to avoid ambiguities in signs the proof will be specifically applicable to the configuration 1. (The ambiguities in question are due to differences in purely conventional definitions of analogous concepts in surveying and analytic geometry, such as azimuth and inclination.) We introduce the parameter θ, which may be thought of as the inclination of the line QR with respect to the "axis" AB, in order to find a designation for all the angles shown in figure 4 and to indicate their functional relation. The determination of P is then treated as an intersection from the fixed base AB by means of the angles BAP and ABP which are obviously dependent on the mutually independent quantities α, β, γ, and δ. The displacement dP of P, resulting from arbitrary displacements $d\alpha$, $d\beta$, $d\gamma$, and $d\delta$, can be resolved into the radial displacement dAP and a displacement $AP \cdot d(\theta - \gamma)$ which is at right angles to it. It then follows from the law of propagation of errors that the square of the displacement probable error of P is equal to the sum of the squares of the probable errors corresponding to these (or any other two) mutually orthogonal displacements.[2]

From figure 4

$$\tan\theta = \frac{AR\sin\beta + AQ\sin\delta}{AR\cos\beta - AQ\cos\delta} \qquad (1)$$

where now and henceforth α, β, γ, and δ will stand for the absolute (non-oriented) values of the corresponding measured (oriented) angles. This will create no ambiguity in the application of our eventual formula (19) since it contains only the squares of the sines of these angles.

Equalities (2) are obtained from figure 4 using the law of sines. Substituting these in (1) results in (3′) which easily transforms to (3).

$$AR = \frac{AB\sin\alpha}{\sin\overline{\alpha+\beta}} \qquad AP = \frac{AB\sin\overline{\theta+\delta}}{\sin\overline{\gamma+\delta}}$$

$$BR = \frac{AB\sin\beta}{\sin\overline{\alpha+\beta}} \qquad BP = \frac{AB\sin\overline{\theta-\gamma}}{\sin\overline{\gamma+\delta}} \qquad (2)$$

$$AQ = \frac{AB\sin\gamma}{\sin\overline{\gamma+\delta}} \qquad AS = \frac{AB\sin\overline{\theta-\beta}}{\sin\overline{\alpha+\beta}}$$

$$BQ = \frac{AB\sin\delta}{\sin\overline{\gamma+\delta}} \qquad BS = \frac{AB\sin\overline{\theta+\alpha}}{\sin\overline{\alpha+\beta}}$$

$$\tan\theta = \frac{\dfrac{AB\sin\alpha\sin\beta}{\sin\overline{\alpha+\beta}} + \dfrac{AB\sin\gamma\sin\delta}{\sin\overline{\gamma+\delta}}}{\dfrac{AB\sin\alpha\cos\beta}{\sin\overline{\alpha+\beta}} - \dfrac{AB\sin\gamma\cos\delta}{\sin\overline{\gamma+\delta}}} \qquad (3')$$

$$\tan\theta = \frac{\sin\alpha\sin\beta\sin\overline{\gamma+\delta} + \sin\gamma\sin\delta\sin\overline{\alpha+\beta}}{\sin\alpha\cos\beta\sin\overline{\gamma+\delta} - \sin\gamma\cos\delta\sin\overline{\alpha+\beta}} \qquad (3)$$

Designate, for brevity, the right hand side of (3) $\equiv \frac{N}{D}$ and let $N^2 + D^2 = H^2$ (Fig. 5). Differentiating (3), function of the independent variables α, β, γ, and δ, yields (4′) which is rewritten as (4″), the primes in the formula denoting partial differentiation with respect to the indicated subscripts. Equation (4) follows on using the relation $D^2 = H^2 \cos^2 \theta$ (Fig. 5).

$$\sec^2\theta\, d\theta = \frac{\partial}{\partial\alpha}\left(\frac{N}{D}\right)d\alpha + \frac{\partial}{\partial\beta}\left(\frac{N}{D}\right)d\beta + \frac{\partial}{\partial\gamma}\left(\frac{N}{D}\right)d\gamma + \frac{\partial}{\partial\delta}\left(\frac{N}{D}\right)d\delta \tag{4'}$$

$$d\theta = \frac{\cos^2\theta}{D^2}(DN'_\alpha - ND'_\alpha)\,d\alpha + \cdots + \frac{\cos^2\theta}{D^2}(DN'_\delta - ND'_\delta)\,d\delta \tag{4''}$$

$$d\theta = \frac{(DN'_\alpha - ND'_\alpha)\,d\alpha + \cdots + (DN'_\delta - ND'_\delta)\,d\delta}{H^2} \tag{4}$$

Partial differentiation with respect to α of N and D, the numerator and denominator, respectively, of the right hand side of (3) yields the quantities (5′) necessary to evaluate (5″) which is the coefficient of $d\alpha$ in the numerator of (4). The other three coefficients are found in similar fashion whereupon (4) becomes (5).

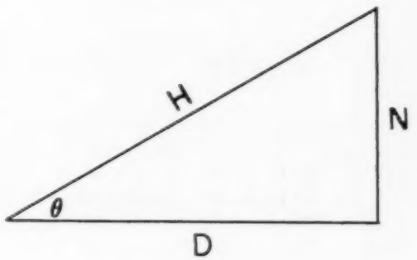

FIGURE 5.

Squaring the numerator and denominator of the right side of (3) and dividing the sum by $\sin^2 \overline{\alpha+\beta} \sin^2 \overline{\gamma+\delta}$ results in equation (6′) which, when put in the form (6″) becomes, upon substitution from (2) the equation (6‴). The right hand side of this last equation is, from the law of cosines, easily seen to equal $RQ^2 \div AB^2$.

$$\begin{aligned} N'_\alpha &= \cos\alpha \sin\beta \sin\overline{\gamma+\delta} + \cos\overline{\alpha+\beta} \sin\gamma \sin\delta \\ D &= \sin\alpha \cos\beta \sin\overline{\gamma+\delta} - \sin\overline{\alpha+\beta} \sin\gamma \cos\delta \\ N &= \sin\alpha \sin\beta \sin\overline{\gamma+\delta} + \sin\overline{\alpha+\beta} \sin\gamma \sin\delta \\ D'_\alpha &= \cos\alpha \cos\beta \sin\overline{\gamma+\delta} - \cos\overline{\alpha+\beta} \sin\gamma \cos\delta \end{aligned} \tag{5'}$$

$$\begin{aligned} DN'_\alpha - ND'_\alpha &= \sin\beta \sin\overline{\gamma+\delta} \sin\gamma \cos\delta(-\cos\alpha \sin\overline{\alpha+\beta} + \sin\alpha \cos\overline{\alpha+\beta} \\ &\quad + \cos\beta \sin\gamma \sin\delta \sin\overline{\gamma+\delta}(\cos\alpha+\beta \sin\alpha - \sin\overline{\alpha+\beta} \cos\alpha) \\ &= -\sin\beta \sin\gamma \sin\overline{\gamma+\delta} \sin\overline{\beta+\delta} \end{aligned} \tag{5''}$$

$$\begin{aligned} d\theta = \frac{1}{H^2}(&-\sin\beta \sin\gamma \sin\overline{\gamma+\delta} \sin\overline{\beta+\delta}\, d\alpha + \sin\alpha \sin\delta \sin\overline{\alpha+\gamma} \sin\overline{\gamma+\delta}\, d\beta \\ &+ \sin\alpha \sin\delta \sin\overline{\alpha+\beta} \sin\overline{\beta+\delta}\, d\gamma - \sin\beta \sin\gamma \sin\overline{\alpha+\beta} \sin\overline{\alpha+\gamma}\, d\delta \end{aligned} \tag{5}$$

$$\frac{N^2+D^2}{\sin^2\overline{\alpha+\beta}\,\sin^2\overline{\gamma+\delta}} = \frac{\sin^2\alpha}{\sin^2\overline{\alpha+\beta}} + \frac{\sin^2\gamma}{\sin^2\overline{\gamma+\delta}} - \frac{2\sin\alpha}{\sin\overline{\alpha+\beta}} \cdot \frac{\sin\gamma}{\sin\overline{\gamma+\delta}} \cdot \cos\overline{\beta+\delta} \qquad (6')$$

$$\frac{1}{AB^2}\left[\left(\frac{AB\sin\alpha}{\sin\overline{\alpha+\beta}}\right)^2 + \left(\frac{AB\sin\gamma}{\sin\overline{\gamma+\delta}}\right)^2 - 2\left(\frac{AB\sin\alpha}{\sin\overline{\alpha+\beta}}\right)\left(\frac{AB\sin\gamma}{\sin\overline{\gamma+\delta}}\right)\cos\overline{\beta+\delta}\right] \qquad (6'')$$

$$\frac{1}{AB^2}\left[AR^2 + AQ^2 - 2(AR)(AQ)\cos\overline{\beta+\delta}\right] \qquad (6''')$$

Hence

$$H^2 = \frac{RQ^2}{AB^2}\sin^2\overline{\alpha+\beta}\,\sin^2\overline{\gamma+\delta} \qquad (6)$$

which is otherwise evident from (1), the expression set up for tan θ. The expression $\sqrt{N^2+D^2}$ is obviously proportional to the hypotenuse RQ, the factor of proportionality being the quantity $\dfrac{\sin\overline{\alpha+\beta}\,\sin\overline{\gamma+\delta}}{AB}$ by which the numerator and denominator of (3′) were multiplied in clearing of fractions to obtain (3).

Differentiating the expression for AP in (2) gives (7′). Substituting for $d\theta$ in this from (5) we obtain dAP in terms of the differentials of the independent variables α, β, γ, and δ as shown in (7). This is the radial displacement along AP of the resected point P resulting from increments $d\alpha$, $d\beta$, $d\gamma$, and $d\delta$ in the observed angles. The displacement of P at right angles to the radial displacement is AP multiplied by the increment to the angle BAP or $AP \cdot d(\theta-\gamma)$. This quantity is shown in (8).

$$dAP = \frac{AB}{\sin^2\overline{\gamma+\delta}}\left(\sin\overline{\gamma+\delta}\,\cos\overline{\theta+\delta}\,d\theta - \sin\overline{\theta+\delta}\,\cos\overline{\gamma+\delta}\,d\gamma - \sin\overline{\theta-\gamma}\,d\delta\right) \qquad (7')$$

$$\begin{aligned} dAP = \frac{AB}{\sin^2\overline{\gamma+\delta}}\Bigg[& -\frac{\sin\beta\sin\gamma\sin\overline{\beta+\delta}\sin^2\overline{\gamma+\delta}\cos\overline{\theta+\delta}}{H^2}\,d\alpha \\ & + \frac{\sin\alpha\sin\delta\sin\overline{\alpha+\gamma}\sin^2\overline{\gamma+\delta}\cos\overline{\theta+\delta}}{H^2}\,d\beta \\ & + \left(\frac{\sin\alpha\sin\delta\sin\overline{\alpha+\beta}\sin\overline{\beta+\delta}\sin\overline{\gamma+\delta}\cos\overline{\theta+\delta}}{H^2} - \sin\overline{\theta+\delta}\cos\overline{\gamma+\delta}\right)d\gamma \\ & - \left(\frac{\sin\beta\sin\gamma\sin\overline{\alpha+\beta}\sin\overline{\alpha+\gamma}\sin\overline{\gamma+\delta}\cos\overline{\theta+\delta}}{H^2} + \sin\overline{\theta-\gamma}\right)d\delta\Bigg] \end{aligned} \qquad (7)$$

$$AP(d\theta - d\gamma) = \frac{AB\sin\overline{\theta+\delta}}{\sin\overline{\gamma+\delta}}\left[-\frac{\sin\beta\sin\gamma\sin\overline{\gamma+\delta}\sin\overline{\beta+\delta}}{H^2}d\alpha + \frac{\sin\alpha\sin\delta\sin\overline{\alpha+\gamma}\sin\overline{\gamma+\delta}}{H^2}d\beta\right.$$
$$\left. + \left(\frac{\sin\alpha\sin\delta\sin\overline{\alpha+\beta}\sin\overline{\beta+\delta}}{H^2} - 1\right)d\gamma - \frac{\sin\beta\sin\gamma\sin\overline{\alpha+\beta}\sin\overline{\alpha+\gamma}}{H^2}d\delta\right] \quad (8)$$

Equation (7) is a linear form of the type (9), and the law of propagation of errors[3] states that, since α, β, γ, and δ are independent variables, the probable error ϵ_{AP}, say, of AP in terms of the probable errors ϵ_α, ϵ_β, ϵ_γ, ϵ_δ of α, β, γ, δ respectively can be obtained from (10). Applying similar considerations to (8) gives the square of the probable error of displacement of the point P in a direction orthogonal to AP in the form (10) where, for instance, D_α is the coefficient of $d\alpha$ in (8). Adding (10) and (11) gives the position probable error ϵ_P of the point P as shown in (12), where $k_\alpha = C_\alpha^2 + D_\alpha^2$, *etc.*

$$dAP = C_\alpha d\alpha + C_\beta d\beta + C_\gamma d\gamma + C_\delta d\delta \quad (9)$$

$$\epsilon_{AP}^2 = C_\alpha^2\epsilon_\alpha^2 + C_\beta^2\epsilon_\beta^2 + C_\gamma^2\epsilon_\gamma^2 + C_\delta^2\epsilon_\delta^2 \quad (10)$$

$$D_\alpha^2\epsilon_\alpha^2 + D_\beta^2\epsilon_\beta^2 + D_\gamma^2\epsilon_\gamma^2 + D_\delta^2\epsilon_\delta^2 \quad (11)$$

[3] Ibid, Par. 5.

$$\epsilon_P^2 = K_\alpha\epsilon_\alpha^2 + K_\beta\epsilon_\beta^2 + K_\gamma\epsilon_\gamma^2 + K_\delta\epsilon_\delta^2 \quad (12)$$

We now proceed to the evaluation of the k's in (12). According to (10), (11), and (12), k_α is the sum of the squares of the coefficients of $d\alpha$ in (7) and (8) as shown in the first line of the development of (13). The second line follows by use of equation (6) and the fourth line by substitution from (2). Proceeding in similar fashion $k_\beta = \frac{1}{H^4}(AB^2\sin^2\alpha\sin^2\delta\sin^2\overline{\alpha+\gamma})$ reduces to (14). In evaluating k_γ (15′) is first reduced to (15″). As in the reduction of k_α, the first term inside the bracket of (15″) is found to equal BQ^2. The third term is obviously $-2BQ\cdot RQ\cos\overline{\theta-\gamma}$ and hence, from the law of cosines, the terms inside the brackets sum to BR^2. The factor outside the brackets can easily be shown to equal $AP^2/RQ^2\sin^2\overline{\gamma+\delta}$ and (15) follows. Likewise (16′) when written in the form (16″) leads to (16).

$$K_\alpha = \frac{AB^2}{\sin^4\overline{\gamma+\delta}}\cdot\frac{\sin^2\beta\sin^2\gamma\sin^2\overline{\beta+\delta}\sin^4\overline{\gamma+\delta}\cos^2\overline{\theta+\delta}}{H^4} + \frac{AB^2\sin^2\overline{\theta+\delta}}{\sin^2\overline{\gamma+\delta}}\cdot\frac{\sin^2\beta\sin^2\gamma\sin^2\overline{\gamma+\delta}\sin^2\overline{\beta+\delta}}{H^4}$$
$$= \frac{AB^2\sin^2\beta\sin^2\gamma\sin^2\overline{\beta+\delta}}{H^4} = \frac{AB^4\sin^2\beta\sin^2\gamma\sin^2\overline{\beta+\delta}}{RQ^4\sin^4\overline{\alpha+\beta}\sin^4\overline{\gamma+\delta}}$$
$$= \frac{1}{RQ^2\sin^2\overline{\gamma+\delta}}\cdot\frac{AB^2\sin^2\beta}{\sin^2\overline{\alpha+\beta}}\cdot\frac{AB^4}{RQ^2}\cdot\frac{\sin^2\gamma}{\sin^2\overline{\gamma+\delta}}\cdot\frac{\sin^2\overline{\beta+\delta}}{\sin^2\overline{\theta-\beta}}\cdot\frac{\sin^2\overline{\theta-\beta}}{\sin^2\overline{\alpha+\beta}} \quad (13)$$
$$= \frac{1}{RQ^2\sin^2\overline{\gamma+\delta}}\,BR^2\cdot\frac{AB^4}{RQ^2}\cdot\frac{RQ^2}{AQ^2}\cdot\frac{AS^2}{AB^2}$$
$$= \frac{BR^2\cdot AS^2}{RQ^2\sin^2\overline{\gamma+\delta}}$$

$$K_\beta = \frac{AR^2 \cdot BS^2}{RQ^2 \sin^2\overline{\gamma+\delta}} \tag{14}$$

$$K_\gamma = \frac{AB^2}{\sin^4\overline{\gamma+\delta}} \left(\frac{\sin^2\alpha \sin^2\delta \sin^2\overline{\alpha+\beta} \sin^2\overline{\beta+\delta} \sin^2\overline{\gamma+\delta} \cos^2\overline{\theta+\delta}}{H^4} + \sin^2\overline{\theta+\delta} \cos^2\overline{\gamma+\delta} \right.$$

$$\left. - \frac{2 \sin\alpha \sin\delta \sin\overline{\alpha+\beta} \sin\overline{\beta+\delta} \sin\overline{\gamma+\delta} \cos\overline{\theta+\delta} \sin\overline{\theta+\delta} \cos\overline{\gamma+\delta}}{H^2} \right) \tag{15'}$$

$$+ \frac{AB^2 \sin^2\overline{\theta+\delta}}{\sin^2\overline{\gamma+\delta}} \left(\frac{\sin^2\alpha \sin^2\delta \sin^2\overline{\alpha+\beta} \sin^2\overline{\beta+\delta}}{H^4} + 1 - \frac{2 \sin\alpha \sin\delta \sin\overline{\alpha+\beta} \sin\overline{\beta+\delta}}{H^2} \right)$$

$$K_\gamma = \frac{AB^2 \sin^2\overline{\theta+\delta}}{RQ^2 \sin^4\overline{\gamma+\delta}} \left(\frac{AB^4 \sin^2\alpha \sin^2\delta \sin^2\overline{\beta+\delta}}{RQ^2 \sin^2\overline{\gamma+\delta} \sin^2\overline{\alpha+\beta} \sin^2\overline{\theta+\delta}} + RQ^2 - \frac{2AB^2 \sin\alpha \sin\delta \sin\overline{\beta+\delta}}{\sin\overline{\gamma+\delta} \sin\overline{\alpha+\beta} \sin\overline{\theta+\delta}} \cdot \cos\overline{\theta-\gamma} \right) \tag{15''}$$

$$K_\gamma = \frac{BR^2 \cdot AP^2}{RQ^2 \sin^2\overline{\gamma+\delta}} \tag{15}$$

$$K_\delta = \frac{AB^2}{\sin^4\overline{\gamma+\delta}} \left(\frac{\sin^2\beta \sin^2\gamma \sin^2\overline{\alpha+\beta} \sin^2\overline{\alpha+\gamma} \sin^2\overline{\gamma+\delta} \cos^2\overline{\theta+\delta}}{H^4} + \sin^2\overline{\theta-\gamma} \right.$$

$$+ \frac{2 \sin\beta \sin\gamma \sin\overline{\alpha+\beta} \sin\overline{\alpha+\gamma} \sin\overline{\gamma+\delta} \cos\overline{\theta+\delta} \sin\overline{\theta-\gamma}}{H^2} \tag{16'}$$

$$\left. + \frac{AB^2 \sin^2\overline{\theta+\delta} \sin^2\beta \sin^2\gamma \sin^2\overline{\alpha+\beta} \sin^2\overline{\alpha+\gamma}}{H^4 \sin^2\overline{\gamma+\delta}} \right)$$

$$K_\delta = \frac{AB^2 \sin^2\overline{\theta-\gamma}}{RQ^2 \sin^4\overline{\gamma+\delta}} \left(\frac{AB^4 \sin^2\beta \sin^2\gamma \sin^2\overline{\alpha+\gamma}}{RQ^2 \sin^2\overline{\gamma+\delta} \sin^2\overline{\alpha+\beta} \sin^2\overline{\theta-\gamma}} + RQ^2 - \frac{2AB^2 \sin\beta \sin\gamma \sin\overline{\alpha+\gamma}}{\sin\overline{\gamma+\delta} \sin\overline{\alpha+\beta} \sin\overline{\theta-\gamma}} \cos\pi - \overline{\theta+\delta} \right) \tag{16''}$$

$$K_\delta = \frac{AR^2 \cdot BP^2}{RQ^2 \sin^2\overline{\gamma+\delta}} \tag{16}$$

Combining these results with (12) equation (17) follows and exhibits the position probable error of P in terms of the errors in the observed angles. By analogy the position probable error ϵ_s for the other new point S is as designated in (18). The usual assumption regarding the probable errors of the observed angles α, β, γ, and δ is that they are all equal. Setting, therefore, $\epsilon_\alpha = \epsilon_\beta = \epsilon_\gamma = \epsilon_\delta = n'' = 0.485\, n \cdot 10^{-5}$, and using (6) and (2) we obtain for (17) and (18) the symmetrical formulas (19).

$$\epsilon_p^2 = \frac{1}{RQ^2 \sin^2(\gamma+\delta)} (BR^2 \cdot AS^2 \epsilon_\alpha^2 + AR^2 \cdot BS^2 \epsilon_\beta^2 + BR^2 \cdot AP^2 \epsilon_\gamma^2 + AR^2 \cdot BP^2 \epsilon_\delta^2) \tag{17}$$

$$\epsilon_s^2 = \frac{1}{RQ^2 \sin^2(\alpha+\beta)} (BQ^2 \cdot AS^2 \epsilon_\alpha^2 + AQ^2 \cdot BS^2 \epsilon_\beta^2 + BQ^2 \cdot AP^2 \epsilon_\gamma^2 + AQ^2 \cdot BP^2 \epsilon_\delta^2) \tag{18}$$

$$\epsilon_p = \frac{0.485 n \cdot 10^{-5}}{H} \sqrt{(BS^2 + BP^2)\sin^2\alpha + (AS^2 + AP^2)\sin^2\beta}$$

$$\epsilon_s = \frac{0.485 n \cdot 10^{-5}}{H} \sqrt{(BP^2 + BS^2)\sin^2\gamma + (AP^2 + AS^2)\sin^2\delta} \tag{19}$$

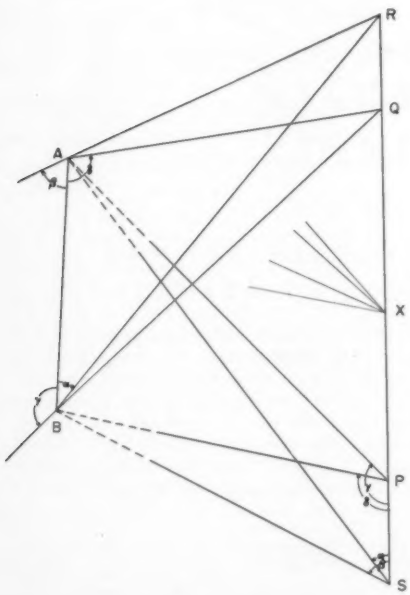

FIGURE 6.

Example: An actual surveying problem will illustrate the use and application of the formulas (19). The angles

$$\alpha = 36^\circ\ 23'\ 08''$$
$$\beta = 61^\circ\ 53'\ 09''$$
$$\gamma = 135^\circ\ 58'\ 55''$$
$$\delta = 102^\circ\ 23'\ 34''$$

were observed, as indicated in figure 6, to the triangulation stations A and B which are 9578 feet apart. The line AB is drawn to any convenient scale and the points R and Q constructed with angles α, β, γ, and δ. On RQ take any point X and draw lines in the observed directions. Parallels to these lines passing through A or B establish the unknown points P and S on RQ.

The following distances are measured on the scale drawing:

RQ = 3,650 ft.
BS = 14,200 ft.
BP = 12,900 ft.
AS = 20,100 ft.
AP = 17,100 ft.

Other data needed for the formula are:

$$\sin^2 \alpha = 0.5932^2$$
$$\sin^2 \beta = 0.8820^2$$
$$\sin^2 \gamma = 0.6949^2$$
$$\sin^2 \delta = 0.9767^2$$
$$\sin APB = 0.5531$$
$$\sin ASB = 0.4305$$
$$\frac{1}{H} = \frac{AB}{RQ \sin APB \sin ASB}$$

The displacement probable errors of the two new points P and S are therefore from (19):

$$\epsilon_P = 0.485 \times 11.02\, n \times 10^{-5} [(14200^2 + 12900^2)\, 0.5932^2 + (20100^2 + 17100^2)\, 0.8820^2]^{\frac{1}{2}}$$
$$= 1.38 \text{ feet for each second p.e. in the observed angles}$$

$$\epsilon_S = 0.485 \times 11.02\, n \times 10^{-5} [(12900^2 + 14200^2)\, 0.6949^2 + (17100^2 + 20100^2)\, 0.9767^2]^{\frac{1}{2}}$$
$$= 1.55 \text{ feet } (n'')$$

State of Washington—Bureau of Surveys and Maps

The Washington State Bureau of Surveys and Maps was created to coordinate surveying and mapping activities in the State, to collect and to catalog surveying and mapping information in the State, and to advise engineers, land surveyors, and cartographers of new developments in surveying techniques, standards, instruments, and publications. Recently their first newsletter-type bulletin was published in the interests of bringing surveyors and cartographers of the State of Washington more closely together. The address of the Bureau is P.O. Box 110, Olympia, Wash.

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Glenad

By DONALD W. STIPP

LOS ANGELES COUNTY ROAD DEPARTMENT

DESCRIBED HEREIN is a method of level-net adjustment recently developed by the Survey Section of the Los Angeles County Road Department. The method combines features of the observation-equation and circuit-reduction methods and renders solutions through graphical means. It is referred to as GLENAD (Graphical LEvel Net ADjustment). After field observations have been reduced to a simple schematic sketch, no further computations are necessary; the final adjusted elevations being read directly from the completed graph. Glenad was developed to simplify the adjustment of simple secondary nets hung upon fixed primary bench marks, and is serving nobly for that purpose. One of the commendable features of Glenad is that that it does not tie up the use of a calculating machine or a high-salaried engineer. The adjustment may be made quickly and accurately by any competent draftsman using the ordinary tools of his profession.

It is assumed that the surveyor is more or less familiar with circuit-reduction techniques,[1] wherein lines of levels originating at several fixed bench marks and coming together at a junction point are reduced to a single hypothetical line of levels terminating at the junction point with the same elevation as the weighted-mean elevation of the actual lines of levels. This hypothetical line is also supposed to originate at a bench mark at such distance from the junction point that the hypothetical line has a weight equal to the sum of the weights of the actual lines of levels.

Glenad is essentially a process of plotting vectors of all known factors at a junction point. Unknown factors, naturally, cannot be plotted at first but are filled in later during the back solution. A single resultant vector is determined from the known factors and translated forward to the next junction point where it is plotted along with the other known condition vectors at that point. A resultant vector is again determined and translated forward to the next junction point, and so on through the net. Arriving at the last junction point, it will be seen that all the factors are known, the vector diagram at this point is complete, and the resultant vector is the adjusted elevation being sought for this junction point.

This resultant vector is now translated back to the previous junction point where it will be seen to complete the vector diagram at that point; the final resultant vector here again being the desired adjusted elevation of this junction point. This final resultant vector is then translated back to the next junction point and will complete the vector diagram at that point; and so on back to the first junction point to complete the adjustment.

PREPARATION OF THE SCHEMATIC SKETCH

In any method of level-net adjustment, it is necessary to present the results of the field work to the adjuster in an easily interpreted manner and in a form most readily adapted to the method of adjustment to be employed. A schematic sketch is well suited for the method being demonstrated, because it aids the adjuster in visualizing the circuits being reduced.

The adjustment being considered consists of determining the most probable elevations for bench marks X, Y, and Z, predicated upon the observed differences of elevation from the fixed bench marks A, B, C, D, E, F, and G, as shown in figure 1. The net may be reduced by inspection to the "herring-bone" type frame shown in figure 2. The bench marks are labeled with their

[1] The reader is referred to Special Publication No. 240 of the Coast and Geodetic Survey for the theoretical development of the Circuit-Reduction Method.

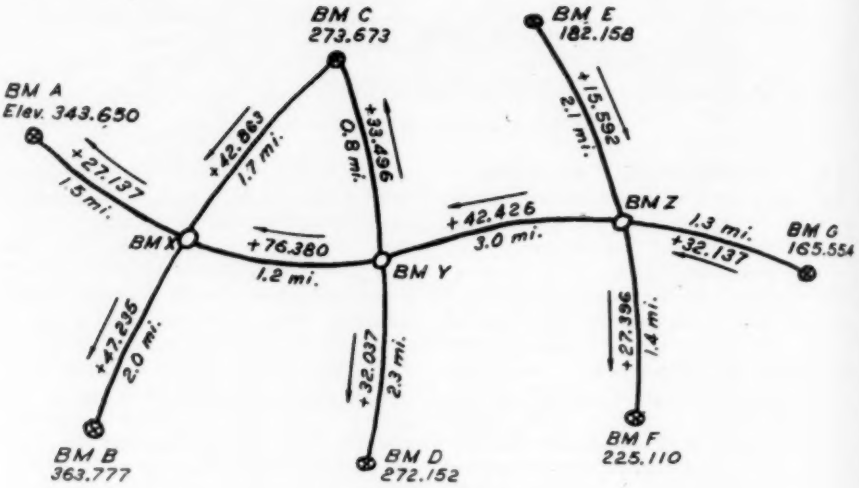

FIGURE 1.

respective identifying characters, and each level line is given a number. Lines originating at fixed bench marks will be called "fixed lines." Line between junction points will be called "junction lines." The observed elevation at the junction-point end of each fixed line is determined and written near the junction point. (*See* Figure 2.) The observed difference of elevation between two junction points is written near the middle of the line connecting the junction points, and an arrow indicates the direction in which the *sign* of the difference of elevation applies. Weights are determined in the usual manner and written along the proper lines on the diagram.

PREPARATION OF THE GRAPH

Cross section paper, having one heavy line per inch, both horizontally and verti-

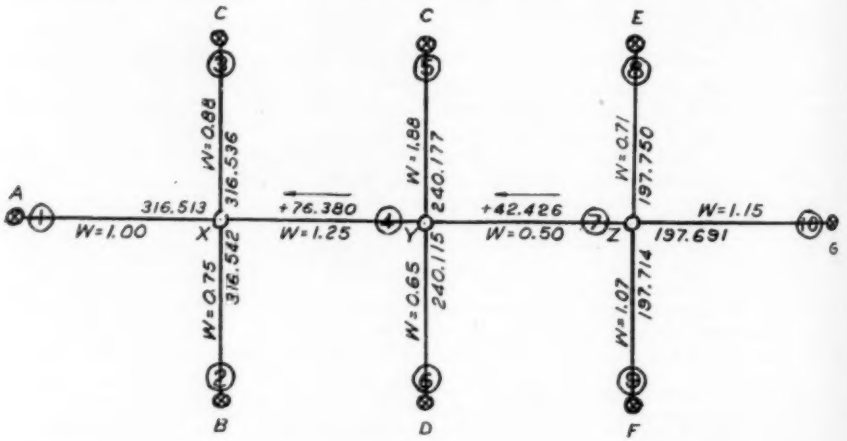

FIGURE 2.

cally, and further subdivided by light lines every tenth of an inch, serves very well for the graph paper. The elevations are plotted as ordinates and the weights of the level lines as abscissas. The scales to be used depend on the accuracy desired and, to a lesser extent, on whether English or metric units are used.

In this demonstration, English units will be used, and we will want the probable error of the result to be not greater than ± 0.001 foot. To meet these requirements, we will use a vertical scale of 1″ on the graph equals 0.05 foot of elevation. In plotting differences of elevation, we will use a regular engineer's scale, 1″ = 50 ft., so that the "1 foot" graduations on the scale will equal 0.001 foot of difference of elevation on the graph. Starting at the lower lefthand corner of the graph[2] with 0.000 feet, label the appropriate heavy lines on

[2] The original drawing referred to in the following portions of the text proved to be quite unsuited to reproduction as a unit. The various portions of the large diagram were redrawn and result in the six separate illustrations. (Figures 3 to 8, inc.) While this may make them appear to be somewhat confusing, it is believed that the added advantage of increased size and consequent clarity will more than offset the inconvenience of having to visualize six separate diagrams as a part of one large graph. The scale notations at the left edge of each diagram will serve to relate each one to the others involved. —EDITOR

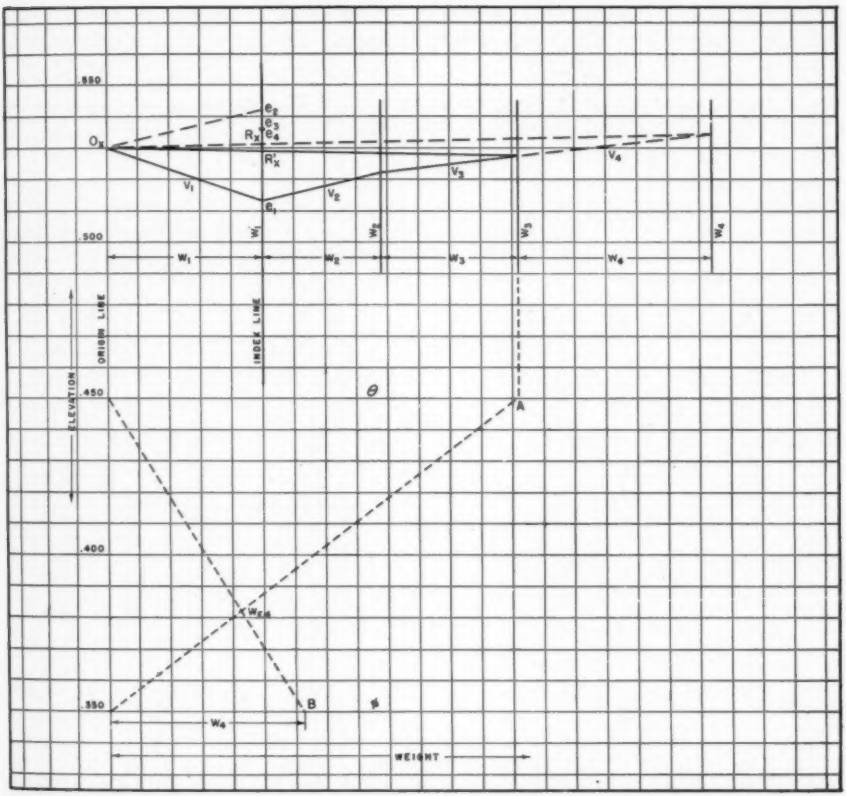

FIGURE 3.

the graph 0.050, 0.100, 0.150, etcetera, increasing upwards to 0.000 again. Throughout the adjustment the unit, or foot, of the elevation is never considered; only the fraction thereof is used. It is assumed that the surveyor knows to what foot the fraction belongs at any junction point. In the metric system the decimeter is used as the unit, permitting elevations to be scaled to the nearest tenth of a millimeter when using the scale suggested above for the graph. The vertical line at the lefthand edge of the graph is called the "origin line" and on it lie the points of origin for all vertical diagrams.

Horizontally, a scale of 1″ = one unit of weight is used when English units of measurement are involved. An engineer's scale, 1″ = 10 ft., is seen to be well adapted to the suggested horizontal scale of the graph. The vertical line one unit, in this case 1 inch, to the right of the origin line is called the "index line." When using metric units it is advisable to spread out the horizontal scale of the graph to get sharper angles of intersection in the vector diagrams, because the errors of closure of the circuits are larger in comparison with the unit than in the English system. Using two inches on the graph for one unit of weight works well, and the corresponding engineer's scale would be 1″ = 50 ft.

The drafting techniques to be employed will not be discussed. It will be left to the ingenuity and skill of the draftsman to use the most accurate methods at his disposal.

MAKING THE ADJUSTMENT

The nature of the work thus far has been essentially the same as for any method of

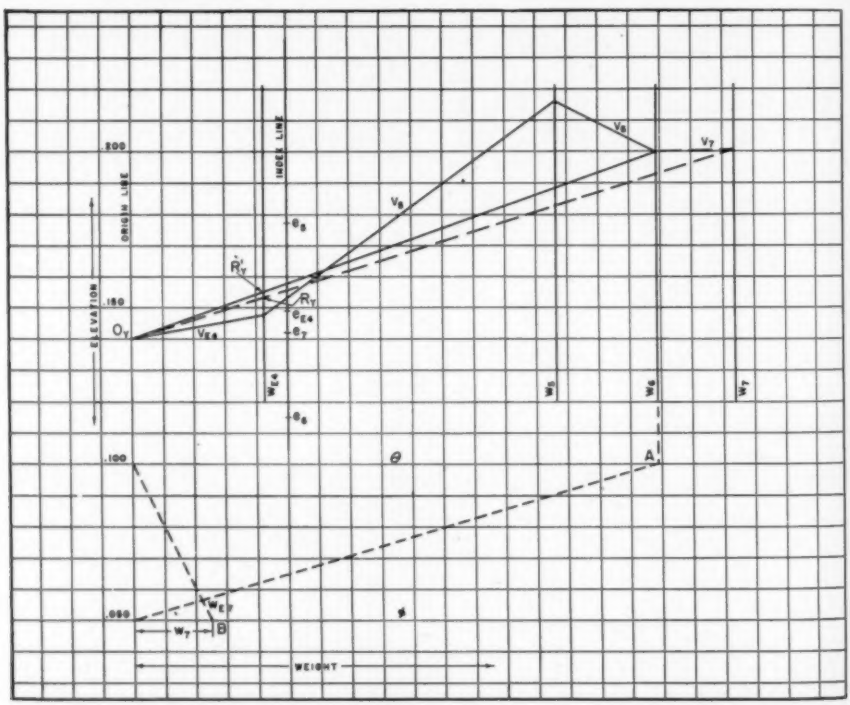

FIGURE 4.

adjustment, namely; the reduction of the field work to usable data, and the preparation of tables and forms to facilitate the actual adjustment. This work having been completed, we are now ready to launch into the adjustment proper.

Forward Solution. First, (*See* Figure 3.) the decimal fractions of the elevations (from the fixed lines) at junction point X are plotted on the index line and labeled e_1, e_2, and e_3, corresponding to the lines they represent. Next, the origin point (O_x) for the vector diagram is selected somewhat arbitrarily on the origin line—approximately opposite the estimated mean of the elevations plotted on the index line. Next, the weights of the lines 1, 2, 3, and 4 are plotted consecutively to the right from O_x. The order in which these points are plotted is immaterial so long as the fixed-line weights are plotted first with the junction-line weights following. Vertical lines, called "weight lines" are now drawn through each of the plotted weight points and labeled—in this case w_1, w_2, w_3, and w_4.

We are now ready to draw the vectors. Lay a straightedge along a line joining O_x and the elevation point corresponding to the first weight line plotted—in this case e_1. The vector, v_1, is now drawn along this line, beginning at O_x and terminating in the line w_1. Next, lay the straightedge on a line between O_x and the elevation point corresponding to the next weight line—in this case e_2. The next vector, v_2, is drawn parallel to this line and begins at the end of v_1 and terminates in w_2. Vector v_3 is drawn parallel to O_x-e_3 and begins at the end of v_2 and terminates in w_3. Because e_4 is unknown to us at this time we cannot plot v_4 yet. Hence, we are ready to sum up the factors at bench mark X as far as we know them. A resultant vector is drawn from O_x to the end of the last vector plotted—in this case, v_3. The point at which this resultant vector crosses the index line, R'_x, is the weighted-mean elevation of bench mark X, from lines 1, 2, and 3.

We now wish to translate this value over to junction point Y, using line 4 as the carrier. To do this mathematically, we would subtract 76.380 (the difference in elevation between X and Y) from the weighted-mean elevation at X. To accomplish this operation on our graph, we merely scale downward along the index line 0.380 (using the appropriate engineer's scale) from R'_x.

The point so plotted is e_{E4} on the graph. (*See* Figure 4.) We have now reduced the levelings along lines 1, 2, 3, and 4 to a single hypothetical equivalent run arriving at junction point Y with an elevation of e_{E4}.

Now we must determine a weight for this hypothetical run so that its elevation at Y and its weight may be entered into the diagram at Y along with the other known factors at that point.

(The author wishes to thank Norman F. Braaten of the Coast and Geodetic Survey

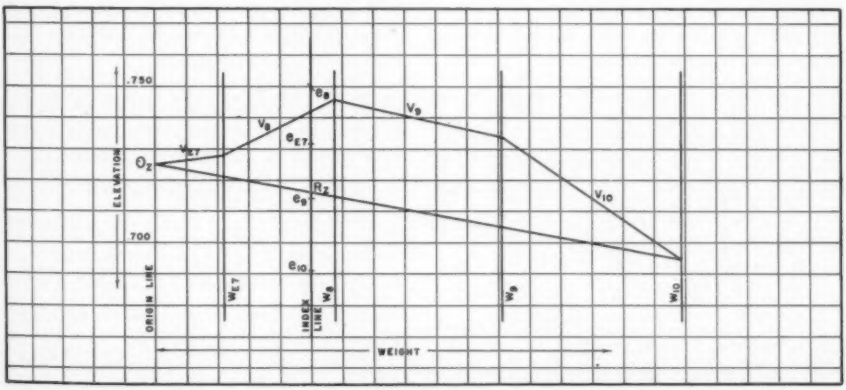

FIGURE 5.

for suggesting the following method for determining the equivalent weight. It is a considerable improvement over the method used in the original development.)

Going back to the vector diagram at X, (*See* Figure 3.) the last weight line used in the diagram—in this case, w_3—is extended either upward or downward to intersect some convenient horizontal printed line on the graph, θ. This intersection is denoted as point A on figure 3. Another convenient horizontal line, Φ, is selected two or three inches upward or downward from line θ. A diagonal line is then drawn from point A to the intersection of line Φ and the origin line. The weight of the junction line (line 4) is then plotted as an abscissa from the origin line along line Φ. This point is denoted at B in figure 3. Another diagonal is now drawn from point B to the intersection of line θ and the origin line. The intersection of the two diagonals occurs at the equivalent weight (abscissa) we have been seeking, and it is labeled w_{E4}. In actual plotting, only enough of each diagonal need be drawn to make the intersection.

Now, returning to the vector diagram at Y, (*See* Figure 4.) the elevations of Y resulting from the fixed lines 5, and 6 are plotted and denoted e_5 and e_6. The origin origin point, O_y, is selected. With a little forethought gained from experience, it may be seen that, by placing the origin point a little above or below the estimated mean of the elevations, the vector diagram may be "steered" away from areas already heavily plotted or from the top or bottom edge of the paper.

In plotting weight lines at Y, the first one plotted will be w_{E4}. This can be done by extending a vertical line from the point w_{E4} at the intersection of the diagonal lines.

Weight lines w_5, w_6, and w_7 are then plotted consecutively to the right from w_{E4}. Vector v_{E4} is then plotted on a line between O_y and e_{E4} and terminates in w_{E4}. Vector v_5 is plotted parallel to O_y-e_5, beginning at the end of v_{E4} and terminating in w_5. Vector v_6 is plotted in the prescribed manner. As was the case at X, the last vector, v_7, cannot be plotted at this time, so the resultant vector summing up the known factors is drawn from O_y to the end of v_6. R'_y is determined at the index line and we are now ready to translate this weighted-mean elevation to junction point Z, using line 7 as the carrier.

As before, this is accomplished by scaling downward from R'_y, 0.426 foot, the decimal fraction of the difference in elevation from Y to Z. However, it will be noticed that this scaled distance runs off the bottom of the graph. It should be readily apparent that we can arrive at the same numerical fraction by mentally subtracting 0.426 from 1.000 and adding, or scaling upward, the resulting distance from R'_y. It should also be noted at this point that the graph need not necessarily begin with 0.000 but may be started with any figure. If it appears that one of the adjusted elevations will fall near an even foot, the graph should be started with some figure other than 0.000.

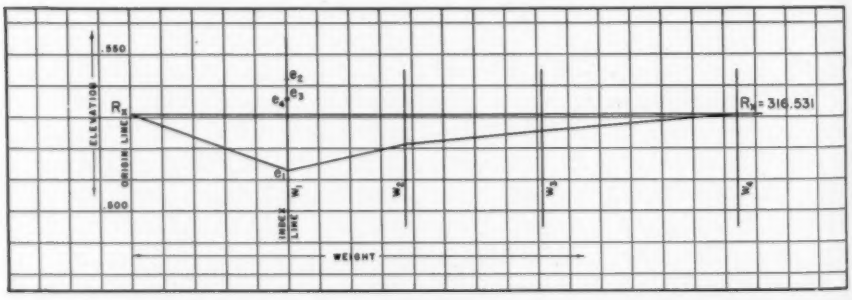

FIGURE 6.

Having now plotted e_{E7}, we determined w_{E7} in a manner identical with that previously explained in determining w_{E4}.

If one cares to analyze the progress to this point, we have now reduced the levelings along lines 1 through 7 to a single equivalent run arriving at bench mark Z with an elevation of e_{E7} with a weight of w_{E7}.

Beginning with the known factors, e_{E7} and w_{E7}, and continuing through vectors v_8, v_9, and v_{10}, the vector diagram at Z (*See* Figure 5.) is plotted as explained for X and Y. One important difference will be noted however. Because all the factors at Z are known, the vector diagram at Z may be completed in its entirety. The resultant vector is drawn as before from O_z to the end of v_{10}. The point at which this resultant vector crosses the index line, R_z, is the final adjusted elevation of bench mark Z.

Back Solution. A final fixed elevation having been established for bench mark Z, line 7 takes on the character of a fixed line. The elevation at the Y end of line 7 is determined by scaling upward 0.426 from R_z. Again in this operation we run off the graph. As before this obstacle is overcome by scaling downward from R_z the difference between 1.000 and 0.426. In this manner point e_7 is plotted on the diagram for the junction at Y. (*See* Figure 4.)[3] Vector v_7 is plotted in the usual manner; being parallel to O_y-e_7, beginning at the end of v_6, and terminating in the line w_7—w_7 having already been plotted in the forward solution. v_7 completes the diagram at Y, so a resultant vector is drawn from O_y to the end of v_7. As before, the point at which the resultant vector cuts the index line, R_y, is the final adjusted elevation of bench mark Y.

R_y is now translated back to X (*See* Figure 3.) by scaling upward 0.380 and e_4 is so plotted. v_4 is plotted at X, the resultant is drawn, and the final adjusted elevation of bench mark X, R_x, is read at the index line and the adjustment is completed.

[3] To clarify the demonstration, lines involved in the forward solution are shown as solid lines. Those involved in the back solution are shown as dashed lines. The dashed lines would not normally be plotted at all.

APPLICATION OF THE CHECK

The drawing of the check diagrams (*See* Figures 6, 7, and 8.) employs the same procedures as used in the adjustment proper. Another graph is used. The final adjusted elevations, R_x, R_y, and R_z, are all plotted on the origin line, and a horizontal line is drawn through each one and extended to the right.

At X (*See* Figure 6.) weight lines are drawn as in the adjustment, and the elevations of fixed lines are plotted on the index line. e_4 is plotted by scaling upward 0.380 from the horizontal line through R_y. Vectors are drawn using R_x as the origin point. If the adjustment has been correctly executed, the end of v_4 will lie on the horizontal line through R_x. This will seldom be the case exactly, because any error will be magnified by the sum of the weights of the lines terminating at the junction point. If the discrepancy seems appreciable, a resultant vector may be drawn and the difference between the resultant and the horizontal line at the index line is the error adjustment.

If the error is more than 0.001 foot when using the scales recommended, it indicates that a mistake has been made in the adjustment. If an error of 0.001 foot is observed, experience indicates that the value registered by the resultant is more apt to represent the true figure. Whether or not it is used in the other check diagrams is of little significance.

At Y (*See* Figure 7.) fixed elevations are plotted as before on the index line, and e_4 and e_7 are plotted by scaling downward 0.380 from the horizontal line through R_x and upward 0.426 from the horizontal line through R_z respectively. Weight lines are drawn and the vectors plotted beginning at R_y. The procedure described for X is followed for Y and Z, and if the closures are acceptable the adjustment is correct.

Adjusted elevations of the junction points will be seen to be identical with those obtained through the use of conventional least-squares adjustments.

It may be noticed that the entire check routine could have been plotted on the adjustment graph merely by extending hori-

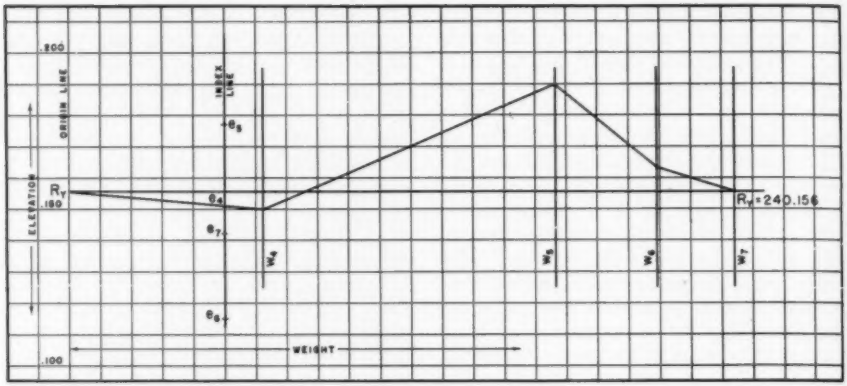

FIGURE 7.

zontal lines through R_x, R_y, and R_z as determined on the index line. However, the use of another graph requires the adjuster to replot the elevations of the fixed lines, which adds to the validity of the check, and also requires him to actually read and record the numerical values of the adjusted elevations. If the adjusted elevations are read and/or plotted incorrectly, the diagrams will not check out .

It should be realized that figures 3 to 8 inclusive, are presented for the purpose of demonstration and that technical acuity has been sacrificed for clarity of presentation. Certain lines have also been added to augment the explanation which would not normally appear in the actual adjustment graph.

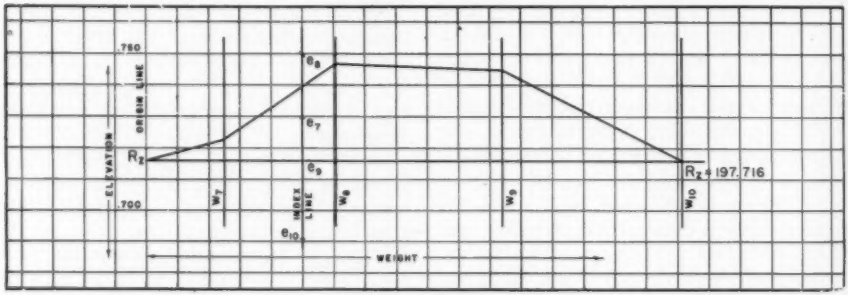

FIGURE 8.

G.P.O. Price List 53

Price list 53 (April 1957) is the 47th edition of Government Printing Office price list covering publications formerly published in Price List 18, Engineering and Surveying. Price List 53 is titled "MAPS, Engineering, Surveying," and lists maps, bulletins, and manuals in the field of surveying and mapping, that may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Write to the above address for your copy of the new catalogue.

Recent Trends in Aeronautical Charting

By FRANK E. McCLUNG

COAST AND GEODETIC SURVEY

UNLIKE MOST PHASES of aviation, charting lacks the drama and glamour necessary to attract or hold the attention for any length of time except, of course, of those few who are vitally interested. It appeals to the minds of men rather than the emotions, and it is the latter which usually stimulates action. How often have we had persons, who have indicated an interest in aeronautical charts, arrive tardily for an appointment and expect to receive a full and detailed explanation in half an hour.

What we need to do is to put this vital vitamin, i, e., charting, in a captivating capsule. How to do it is the problem.

There is a slogan used by salesmen, "sell the sizzle and not the steak." It is mighty hard, however, to get much sizzle out of an aeronautical chart.

In the development and safe performance of air operations it is essential that a current, comprehensive, and authoritative source of navigational data be made available at all times, and aeronautical charts provide the best medium for supplying this information in a usable, condensed, and coordinated manner. The role of aeronautical charts in aviation development is often overlooked or taken for granted, yet all segments of aviation depend on this common reference for air traffic control, navigation, and planning.

Because of the ever increasing complexity of the common system of air navigation and to meet the demands of all aviation interests, charts are published at several scales and for different purposes. Over forty-three million aeronautical charts were printed by the Coast Survey in 1956 involving approximately 1,500 individual charts.

Impressive as this figure may seem, it indicates only in very small measure the magnitude and problems of the Coast Survey's aeronautical charting program. The time and effort necessary for planning, designing, and constructing these charts cannot be measured by numbers alone. An adequate charting program does not develop automatically with changing requirements. Continuing studies must be made in order to meet the needs of all aviation interests. In addition to the new chart construction and modification or revision of existing charts, approximately 500 to 1,000 changes are received daily. These items, obtained from many sources and in varied forms, must be recorded, verified, integrated and entered daily on pertinent charts.

It is apparent that no single phase of aviation can progress independently, and new concepts in aeronautical charting continue to develop. The all-purpose chart is no longer satisfactory for pilot use. This is not a new problem but represents a trend that has evolved and become intensified with the increase in amount of information to be charted, the multiplication in variety and performance characteristics of aircraft, and the shrinkage of free airspace. The expanding use of high performance aircraft, particularly jets, has dramatized the need for these new concepts.

It has, therefore, become necessary to redesign many series of charts. The airborne equipment utilized, proficiency of pilot groups, and performance characteristics of various aircraft must all be considered in determining chart design and type of information to be shown on them. Details which obscure vital information or detract from the primary purpose of charts are hazards rather than the built-in safety factors they are intended to be.

In designing specialized charts, care must be taken to coordinate the series so that a minimum number of charts is required to provide all information a pilot may need in any situation that might arise. Although this has always been an important consid-

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eration, it is far more critical today. To operate high performance aircraft in the ever-increasing volume of traffic, the pilot must devote a minimum amount of time to reference data. Information must be presented in a clear, positive, and orderly fashion.

A few months ago, two Navy pilots flew from Harmon Field, Newfoundland, to Washington. It was an instrument flight all the way with severe turbulence. Atmospheric conditions finally got so bad that a crew member got on his knees between the two pilots to help them read the charts. When they arrived in Washington one pilot turned to the other and said: "I believe we have a total of about 40 years' flying experience. If we had only 39 we never would have made it."

Pilot fatigue is often indicated as the probable cause of navigational errors and as a contributing factor in many crashes. An accurate, well-designed, chart that is easy to read alleviates the tension of flying in adverse weather conditions.

The question often arises as to how often a chart should be revised or the format changed. The answer is—as frequently as necessary to keep the charts current and provide the best charts possible, consistent with changing requirements. Benefits derived from an adequate and progressive charting program are hard to evaluate accurately. For this reason it has always been difficult to obtain sufficient funds. Preventing the loss of one large air carrier will pay for a lot of charts, to say nothing of the possible loss of life.

In all its chart programs the Coast and Geodetic Survey works very closely with those most directly concerned. Numerous experimental charts have been issued and pilot evaluations have been obtained through questionnaires. The treatment of charts—both design and content—is based largely on user evaluation. We have every reason to believe that our analyses are sound.

As we move toward more electronic control, whether ground or airborne, it appears that the radio-facility-chart type of presentation will predominate for inflight use. The radio-facility charts were published in a new format in 1954. Ten charts covering the United States were sufficient to provide a clear portrayal at that time. Only thirty large-scale terminal charts were needed. Today, there are 60 terminal charts and the primary series is so cluttered that it is planned to increase the number from 10 to 18. Several new ideas will be incorporated in the new version so that the charts may be read quickly and easily in all weather and under poor lighting conditions. Simplification is the keynote. The standard Instrument Approach Procedure Charts have also been recently converted to a new small-size format.

In the past, a great amount of terrain and cultural information has been shown on charts. Results of questionnaires, in the last two years, indicate that the need for such detail is limited and does not justify the large size and resulting bulk of these charts. Instead, there is a strong demand for (1) reduction in size and volume for ready reference in flight and convenient stowage and (2) clear and positive portrayal of the procedure.

The sheet size has been reduced one-half by eliminating much of the unessential detail and by showing only information necessary for safe flying. By simplifying and reducing the airport diagram, all information is placed on one side of the sheet, thus allowing an additional procedure for the same airport to be shown on the reverse. The resulting 60 per cent reduction in bulk is of great importance to the pilot as the number of instrument-approach-procedure charts for civil fields has increased from 170 in 1943, to 1,070 in 1956. The current rate of increase is 100 per year, with every indication of a more rapid increase in the immediate future.

As always, a primary objective is to place current and accurate charts in the hands of the pilots quickly. The simplified portrayal will be very beneficial to this end. In the interest of economy and maintenance of service to subscribers, a firm revision schedule has been established. Personnel were transferred from other charting activities to

maintain a smooth and balanced flow of charts. As the size of the charts was changed, the entire series had to be reprinted in order to fit the new small-size binders. Approximately nineteen million charts were processed, printed, assembled, and distributed on schedule. The magnitude of this program is not confined to conversion of the charts alone. Over 3,500 subscriptions had to be reestablished and dovetailed into the current program so that there would be no break in revision service.

After a long period of little or no change, the noninstrument charts, particularly the WACs and Sectionals, are getting a face lifting. With these, as with the instrument series, the aim is to make the charts more useful. The aeronautical data are being simplified and terrain and cultural information of navigational importance are being emphasized. The colors, too, are being changed to provide better contrast for easy reading.

It is interesting to note that, while there have been no complaints about the Sectionals and WACs as now published, the new versions have been enthusiastically endorsed by 99 per cent of the pilots who have used them. This indicates that pilots do not realize charting potentials but are quick to recognize and appreciate a superior product.

The Coast Survey's charting program has many ramifications which are little known. Close liaison is maintained with the CAA in the preparation and printing of numerous special-purpose or study charts required for their aviation-development programs. Charts have also been prepared for the Air Navigation Development Board, the NAV Panel of the Air Coordinating Committee, and others.

During the last year several charts pertaining to the expansion and modernization of the common system of air-traffic control were produced. These programs have a direct bearing on future charting. A program is now under way to design a high altitude route structure for flights above 27,000 feet and preliminary study charts have been prepared. A new series of charts for high altitude navigation is also projected.

The trend is toward positive control of all flights. Full implementation of a system adequate to bring this about will not occur quickly. The current system will only allow for positive control of a very small percentage of air traffic. Electronic devices of various kinds and a complex communications system are in the offing and, of course, personnel must be trained to operate this new equipment.

There is every indication that, during the period of transition and growth, chart makers will be taxed to the utmost in trying to provide a graphic picture of a rapidly changing system. How soon this will affect charts now published cannot be fully visualized at this time. However, in high density areas particularly, many new procedures and others, which have long been in the formative stage, are presenting real problems to pilots and controllers alike Peripheral communication sites, single-direction airways, and preferential routing are a few installations which must be presented in a graphic form. Specialized or schematic charts can fill a vital role in presenting this information clearly. Already in production is a preliminary chart showing preferential routs for the New York area. This chart has been well received and is being evaluated by the New York Air Traffic Control Center.

Traffic controllers have been, in a sense, forgotten men. At the present time they are using charts designed for inflight use, modified, marked up, or tailored in various ways to make them usable for traffic control. In terminal areas particularly, many procedures are or will be put into effect which are not to be shown on navigational charts. The traffic controllers must have a clear picture of all these interrelated procedures in order to do their job with maximum precision and confidence. There will, undoubtedly, soon be a demand for charts especially designed for air-traffic control, and studies are now being made. These charts will be closely coordinated with navigational charts so that there will be uniform interpretation by controller and pilot. They will be at a larger scale and give emphasis

to that information pertinent to control. Uniform treatment of charts for all centers will provide for a better understanding between controllers and promote more efficient operations.

At a recent NBAA meeting in Miami, a very sincere appeal was made by Cole H. Morrow, NBAA Board Member, when he asked for full NBAA cooperation with the CAA and other governmental bodies which are assigned the responsibility of designing and operating the common system of air-traffic control. Captain Ace Robson who writes a column for *Aviation Week* titled "Cockpit Viewpoint" puts it very well when he asks: "Is it not possible to obtain more mutual effect on all aeronautical matters?" Continuing to fight divided only prolongs the agony.

United effort is all important. Graphic aids will contribute much toward an orderly transition to a new era in aviation and will always be fundamental tools. It would be extremely unfortunate if complacency should rob the airman of tomorrow of a valuable and superior instrument and saddle him with an antique and clumsy one. If, in satisfying aviation requirements, charts of the future bear little resemblance to those to which we are accustomed, let's accept the new look; this is progress.

U. S. Contributions to International Organizations

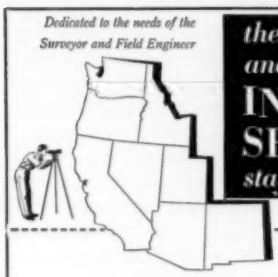
House Document No. 112, 85th Congress, First Session (Government Printing Office, 1957), lists United States contributions to international organizations for the fiscal year 1956 as reported by the Secretary of State. Contributions to the following organizations may be of interest to ACSM members.

International Civil Aviation Organization—U. S. contribution $864,662 = 33.3% of ICAO Budget.

Pan American Institute of Geography and History—U. S. contribution $42,928 = 39.4% of PAIGH Budget.

International Hydrographic Bureau—U. S. contribution $9,997 = 10% of IHB Budget.

—W. W. Ristow



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Trivia

By CLARENCE L. HUNTER

SOUTHERN CALIFORNIA EDISON COMPANY

SEVERAL YEARS AGO, when I was first exposed to the array of sections within a township, I wondered if it would be possible to express the number (N) of a particular section, in terms of the row and column of sections at the intersection of which the particular section was situated. Recently I decided to try my hand at this problem.

To find an explicit expression for N in terms of r and c

$$N = N(r, c)$$

where r denotes the row and c the column, the investigation proceeded as follows:

I numbered the rows and columns shown in figure 1 and noted that for

$$\begin{aligned} r &= 1,\ N = c + 7 \\ r &= 2,\ N = c + 6 \\ r &= 3,\ N = c + 19 \\ r &= 4,\ N = c + 18 \\ r &= 5,\ N = c + 31 \\ r &= 6,\ N = c + 30 \end{aligned} \qquad (1)$$

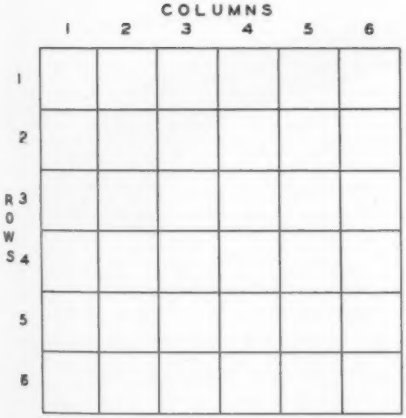

FIGURE 1.

The problem was then to find a relationship between $r = 1$, $r = 2$, . . . $r = 6$ and the constants 7, 6, 19, 18, 31, and 30.

It was first noted that for $r = 1$, 3, and 5 the constants 7, 19, and 31 could be expressed as

$$6r + 1 \qquad (2)$$

and that for $r = 2$, 4, and 6 the constants 6, 18, and 30 could be expressed as

$$6r - 6 \qquad (3)$$

Substituting (2) and (3) for the constants in (1) we have, for

$$\begin{aligned} r &= 1,\ N = -c + 6r + 1 \\ r &= 2,\ N = \ \ c + 6r - 6 \\ r &= 3,\ N = -c + 6r + 1 \\ r &= 4,\ N = \ \ c + 6r - 6 \\ r &= 5,\ N = -c + 6r + 1 \\ r &= 6,\ N = \ \ c + 6r - 6 \end{aligned} \qquad (4)$$

I now had to find a relationship between $r = 1$, $r = 2$, . . . $r = 6$ and the constants 1, -6, 1, -6, 1, and -6.

This was found to be

$$(-1)^{r+1} \cdot 6\,\tfrac{1}{2}\left[1 - (-1)^{r+1}\right] \qquad (5)$$

Substituting (5) for the constants in (4) and generalizing, we arrive at the desired result:

$$N = C(-1)^r + 6r + (-1)^{r+1} \cdot 6\,\tfrac{1}{2}\left[1 - (-1)^{r+1}\right] \qquad (6)$$

Example:

Here we want the number of the section at the intersection of the 5th row and the 4th column.

Substituting $r = 5$ and $c = 4$ into (6) we have

$$N = 4(-1)^5 + 6 \cdot 5 + (-1)^{5+1} \cdot 6^{1/2}\left[1-(-1)^{5+1}\right]$$

$$= 4(-1) + 30 + (1) \cdot 6^0 \qquad (7)$$

$$= -4 + 30 + 1$$

$$= 27$$

which is verified from the diagram. (Figure 2.)

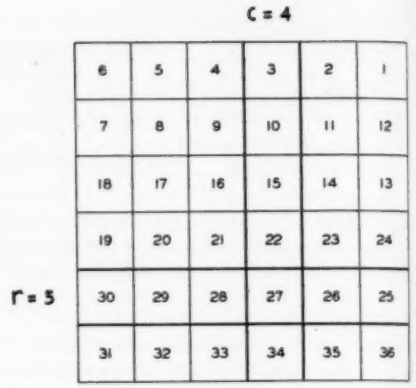

FIGURE 2.

Eleventh General Assembly of International Union of Geodesy and Geophysics

The Eleventh General Assembly of IUGG will be held in Toronto, Canada, September 3–14, 1957. Delegates from more than 40 countries will be attending this international meeting and participating in the activities of the seven associations which comprise the Union. If any member of ACSM desires to attend this meeting, he should get in touch with Waldo E. Smith, Secretary, American Geophysical Union, 1515 Massachusetts Ave., N.W., Washington 5, D. C.

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The Interagency Committee on Map and Chart Symbols

By C. F. FUECHSEL

U. S. GEOLOGICAL SURVEY

THE DESIRABILITY of maintaining a reasonable degree of standardization in symbols and editorial treatment of maps has always been evident to professional cartographers. Cooperation among U. S. Government map and chart publishing agencies was rather casual in earlier years, but as surveying and mapping activities increased, more formal mean of collaboration became established. The first official action which dealt specifically with standardization, was the Executive Order of August 10, 1906, wherein the functions of the U. S. Geographic Board were extended to include "advisory powers . . . concerning the preparation of maps . . . in the various bureaus . . . and for the unification and improvement of . . . the symbols and conventions used upon them. . ."

President Wilson, in 1919, established the Federal Board on Surveys and Maps by Executive Order. This Board was charged with broad advisory responsibilities "for the purpose of coordinating all mapmaking and surveying activities of the Government, and to settle all questions at issue between Executive Departments relating to Surveys and Maps. . ." The additional advisory powers assigned the U. S. Geographic Board in 1906, were thereby rescinded and transferred to the Board of Surveys and Maps. The latter Board functioned until 1942, when it was abolished by Executive Order and its responsibilities transferred to the Bureau of the Budget. Since that time the planning of mapping and charting programs of the various government bureaus, as well as broad technical advisory activities in this field, have been very effectively coordinated by Robert H. Randall of that Bureau.

Several interagency committees have been established by the Bureau of the Budget to assist in various advisory and coordination activities in the fields of surveying and cartography. Among them are the Interagency Committee on Negative Scribing, and the Committee on Map and Chart Symbols. The latter serves as an open forum for discussing problems arising in connection with general efforts to maintain as much standardization as feasible in content, symbolization, and editorial treatment of government maps and charts. The U. S. agencies, which have a primary interest in the activities, and are currently represented on the parent committee include, Aeronautical Chart and Information Center, Army Map Service, Coast and Geodetic Survey, Geological Survey, Hydrographic Office, Lake Survey, and Photographic and Survey Section, J. C. S.

Several other agencies, which have a collateral interest in standardization and related matters or are concerned only with a particular type of map, are represented on one or more of the subcommittees listed below.

Policies of the Committee on Map and Chart Symbols are quite flexible, because the basic purpose is to provide representation for any Government agency which desires to participate in the work of the parent committee or any of its subcommittees. However, because there are many demands on the available time of key people in all agencies, the Committee was started with a relatively small membership, limited to those agencies most directly concerned. Another consideration was the generally accepted view that small and informal groups usually work more efficiently than larger bodies. It should be noted, however, that any Government agency, whether represented on the Committee or not, may submit

Prepared at the request of the Committee on Technical Standards of the Technical Division on Cartography, ACSM.

map or chart symbolization problems for consideration, and participate in any discussions in which they may be interested. Those wishing to submit topics for consideration and/or attend meetings of the subcommittee working in their sphere of interest, may contact Mr. Randall, the writer, or the Appropriate chairman noted below:

Aeronautical Charts—Lt. Col. Marshall B. Shore, Aeronautical Chart and Information Center.

Nautical Charts—J. R. Dickens, Hydrographic Office.

Special Maps—C. G. Finley, Jr., Army Map Service.

Topographic Maps—E. S. Massie, Forest Service.

At the close of World War II, the Joint Mapping and Photo Committee of the Department of Defense sponsored a comprehensive study of symbolization, with a view toward standardizating all maps and charts produced by the Armed Services. Civilian agencies were invited to participate in the discussions, to effect as much uniformity in "civil" and "military" standards as feasible. In view of the recency of this comprehensive review at the time the present Interagency Committee was organized, it was decided to confine activities to immediate problems. The Committee on Map and Chart Symbols has accordingly functioned to date primarily as an advisory group, available to consider specific problems as they arise. Problems of a more general nature have been considered in some of its subcommittees.

The Subcommittee on Topographic Maps recently compiled a list of problems to be studied, after canvassing personnel in various agencies. Certain of these problems have since been discussed and resolved. Others have been deferred until the results of a military maps-use survey, which has been in progress for the past two years at Army Map Service, are clarified. A study is in progress to develop map symbols and styles adapted to negative scribing, which has replaced drafting in most map producing agencies. The Nautical Charts Subcommittee recently reviewed inconsistencies of format and symbolization in this field and adopted appropriate changes. In deference to current studies of aeronautical chart symbols by a military group, the subcommittee on this subject has deferred major activity until the results of these studies are available. The Subcommittee on Special Maps has reviewed symbolization in the small-scale field and plans to issue a report in the near future.

At the Esselte Conference on Applied Cartography, held in Stockholm last summer, considerable interest was shown in studies of map symbolization and format which might lead toward more standardizàtion on an international basis. Some work has been accomplished in this direction among military agencies in recent years. Because of the interest at the Stockholm meeting, and in view of earlier cooperation on map standardization (e.g. the International Map of the World), it was indicated that our committee is welcome to correspondence with and cooperation of similar groups of other countries.

Safety for the Survey Party

Issuance of a new eight-page, pocket-size folding pamphlet entitled "Safety for the Survey Party" has been announced by the Division of Highways (California).

Prepared by the division's Safety Section, the pamphlet provides a guide for the use of warning devices and equipment to protect the traveling public and members of engineering parties whose duties require them to work on streets and highway under open traffic conditions. It contains drawings and diagrams in color illustrating some of the safety equipment and how it should be used for maximum effect.

The pamphlet, which establishes uniform procedures for the protection of survey parties, is published primarily for the information and guidance of employees of the division.

—*California Highways and Public Works*

Library Has Maps of All Places*

By BARBARA P. BERTHELSEN

MAP LIBRARIAN, CORNELL UNIVERSITY

IN THESE DAYS when the educational program is being made more and more effective by the use of recordings and motion pictures in addition to books and lectures, one of the earliest forms of visual aids to education, the map, is at last coming into its own as an educational tool of greater importance in a research library. Maps have long formed part of the collection at Cornell. Still in use are the many city maps bought by Andrew D. White for his personal use and given to the University Library, and the rolled wall maps used to illustrate early lectures. Early scholars at Cornell had access not only to the maps of our own infant U. S. Geological Survey, but also the important large scale surveys of other countries, including Great Britain, Italy, France, Norway, Denmark, and The Netherlands. Present day scholars have at hand more than 40,000 maps embracing a wide selection of regions, subjects, projections, and scales.

The basis of this collection are maps from three of the major depository programs in which Cornell participates. The Army Map Service, which in 1945 undertook to distribute 50,000 maps to each of 188 participating libraries, was temporarily forced to discontinue the project in 1951 with more than half of the maps still unshipped. The maps received as a result of this program form a core collection making available not only the expected and necessary large scale maps of the New York City area or White Sands, N. Mex., but also such far-flung improbabilities as a map of the Murmansk Railway or one of Timbuktu. Our recent large scale maps of the countries of Europe, Asia, and Africa are Army maps. Also among the many sheets actually distributed were city maps for large and small cities all over the world, from a small plan of Mascara, Algeria, to a twenty-one-sheet map of Tokyo; from Reykjavik, Iceland, to Inchon, Korea. Subject maps were more rarely issued than topographic maps, but for anyone needing such information, thanks to the Army Map Service, we can provide a map showing communications on the Malay Peninsula or a set of twelve maps showing the climate of central Brazil from January to December.

Whenever a map of part of the world is needed for which no Army maps have been received, we rely on maps from another depository program. As the U. S. Coast and Geodetic Survey issues new editions of its aeronautical charts, Cornell receives copies of the old editions. These maps come marked "obsolete for use in navigation," but they are not at all obsolete for use as contour maps of an area. They number more than 1700 maps covering the whole world on a uniform scale of 1: 1,000,000. With such maps, students have located obscure villages on caravan routes in central Kazakstan and mining camps on nameless creeks in northern Canada. Supplemented by larger maps covering the world on the smaller scales of 1: 3,000,000 and 1: 5,000,000, these World Aeronautical Charts form one of our most valuable sets of maps.

The most important mapmaking agency in the United States is the U. S. Geological Survey, which deposits with the Cornell University Library a copy of virtually every map it prints. Certainly the most important maps in our collection are the topographic quadrangles issued by the Geological Survey. Students whose assignments involve planning a long-range development program for Waikiki Beach or bombing the major power plants in the city of Boston turn first to these quadrangles. In addition to the topographic maps, the Survey provides us with full sets of its many geological series, including geologic quadrangles, geologic map indexes, coal investigations (both maps and charts), oil and gas investigations

* Reprinted by permission from *Cornell Alumni News*, Vol. 59, No. 12, March 15, 1957.

(both maps and charts), mineral investigations (preliminary maps, field studies maps, and resource appraisal maps), geophysical investigations, and miscellaneous geological investigations. A geologic map of Montana or of just the Hobson area in central Montana, a total intensity aeromagnetic map of Pulaski County, Ind., a chart showing tertiary stratigraphy of the Jackson Hole area in Wyoming, or a geologic map of Panama can all be provided from the depository maps of the Geological Survey.

To supplement these depository sets we use every map in our collection: maps that cover a wall and those that will fit into a vest pocket; maps published a century ago and maps published last month; National Geographic maps, rare maps, and aerial photos. As a Research Library, Cornell must collect and save many kinds of material considered superfluous to a smaller collection. In the wide and unpredictable range of questions asked, it would be completely impossible to compute the practical value of one map against another. The student plotting the shortest route across the Greenland ice cap, the scholar reading an early English text with the aid of a map of Anglo-Saxon Britain, the ROTC students bombing Philadelphia or Seattle or Fontana, Calif., the real estate agent defining a boundary, the person desiring a map showing Timbuktu or the Murmansk Railway or the climate of central Brazil in December—all these make up our everyday requests. The map needed at the moment is the most important map in the collection. Recently a request came by mail for a list of the "basic" maps in our collection. We could only say what we have tried to show here, that all of them are too important to show preference for any one type. Any day now, someone is going to want a map of Erzurum, and he won't mind if the text is in Armenian. When he comes, we'll be ready for him and the map of Erzurum will have its day of glory, as has many a map before it.

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Surveying and Mapping News

Members are requested to send in surveying and mapping news items for publication in SURVEYING AND MAPPING.—EDITOR.

CURRENT SURVEYING AND MAPPING LITERATURE

MAGAZINE ARTICLES

General Interest

INTERIM REPORT OF TASK COMMITTEE ON STATUS OF SURVEYING AND MAPPING. (Received by the Executive Committee of the Surveying and Mapping Division, ASCE, Oct. 18, 1956.) *Civil Engineering*, Vol. 27, No. 3, March 1957. (Includes table of classification of positions in surveying and mapping.)

WHEN THE STARS INTERRUPTED THE RUNNING OF A MERIDIAN LINE NORTHWARD UP THE DELMARVA PENINSULA. Thomas D. Cope. *Proceedings of the American Philosophical Society*, Vol. 100, No. 6, December 1956. (Interesting historical sidelight on one of the most famous boundary surveys.)

SUPPLEMENTS OF THE "AUSTRALIAN SURVEYOR." *The Australian Surveyor*, Vol. 16, No. 4, December 1956. (List of fourteen supplements on as many subjects relating to surveying and mapping available from the offices of the publication, Science House, Gloucester and Essex Streets, Sydney, N. S. W., all but one of which are priced at 3s. per copy.)

NAVARHO. (No author cited.) *Navigation*, Vol. 5, No. 4, December 1956. (Description of a basically different system of aerial navigation control reprinted from *United States Air Force Quarterly Review*.)

OPERATIONS OF THE CANADIAN HYDROGRAPHIC SERVICE—A SYMPOSIUM. *The Canadian Surveyor*, Vol. 13, No. 6, January 1957. (Includes papers on "Hydrographic Field Operations" and "Nautical Chart Cartography" presented at the third of a series of meetings on various phases of surveying and mapping sponsored by the Canadian Institute of Surveying and Photogrammetry.)

A TIDAL SURVEY OF CANADA'S NORTHERN SEAS. Commander W. I. Farquharson. *The Canadian Surveyor*, Vol. 13, No. 6, January 1957. (Describes recent tide gaging activity in areas where tidal information has been very scanty and announces plans to establish two year-round tidal stations to operate during the International Geophysical Year.)

ENGINEERING REGISTRATION: PAST, PRESENT, AND FUTURE. Melvin Nord. *Journal, Florida Engineering Society*, Vol. 10, No. 5, February 1957. (Comparison of engineering registration practices with those in other professions and prediction that eventually there will be no unregistered engineers.)

COAST AND GEODETIC SURVEY; HIGHLIGHTS OF 150 YEARS. Elliott B. Roberts. *United States Naval Institute Proceedings*, Vol. 83, No. 2, February 1957. (Brief, illustrated history of the Survey.)

CHARTING OUR SEA AND AIR LANES. Stuart E. Jones. *The National Geographic Magazine*, Vol. 111, No. 2, February 1957. (Review of the work of the Coast and Geodetic Survey over the 150 years of its existence.)

SESQUICENTENNIAL OF COASTAL CHARTING. Albert A. Stanley. *The Military Engineer*, Vol. 49, No. 324, January–February 1957. (Brief, illustrated history of the work of the Coast and Geodetic Survey from its inception in 1807 to the present time.)

PROBLEMS AND PROGRESS IN AIR PHOTOGRAPHY. G. C. Brock. *The Photogrammetric Record*, Vol. 11, No. 9, April 1957. (A review of progress and the present technical status in air photography.)

Cartography

ROYAL AUSTRALIAN SURVEY CORPS. *Cartography*, Vol. 1, No. 4, September 1956. (Under standard section heading "Contemporary Cartography" describes work of and includes a full color extract from one of the maps produced by the Corps.)

MAP PRODUCERS. Introduction by Marie C. Goodman. *Special Libraries Association, Geography and Map Division, Bulletin No. 27*, February 1957. (Brief but comprehensive descriptions of the organization and work of the Sanborn Map Company, the General Drafting Company, and A. J. Nystrom and Company. May be supplemented by similar articles in future issues of the Bulletin.)

MAPPING IN LATIN AMERICA. Ena L. Yonge. *Special Libraries Association, Geography and Map Division, Bulletin No. 27,* February 1957. (Account of visits by delegates to the 1956 meeting of the International Geographic Union to the official mapping establishments of various Latin American countries.)

ARCADIA IN AMERICA. Ernest Hatch Wilkins. *Proceedings of the American Philosophical Society,* Vol. 101, No. 1, February 15, 1957. (Study, tracing the origin and application of the name, illustrated by reproductions of early maps of North America.)

Control Surveys

SEMI-GRAPHIC METHOD OF ADJUSTING MINOR TRIANGULATION. G. H. Halliday. *New Zealand Surveyor,* Vol. 21, No. 6, Serial No. 210, August 1956. (Comment on an article on the same subject published in a previous issue.)

ADJUSTMENT OF A CHAIN OF TRIANGLES BETWEEN TWO FIXED SIDES: METHOD OF PLANE ANGLES. T. Siurna, Dipl. Eng. *The Canadian Surveyor,* Vol. 13, No. 5, October 1956. (Mathematical exposition of method.)

EFFECT OF TILT ON POSITION LINES. N. R. Fallon. *Empire Survey Review,* Vol. 14, No. 103, January 1957. (Discusses conclusion that tilt may be cause of systematic error in astronomic determination of position lines.)

NOTES ON THE ASTRONOMICAL TRIANGLE. W. Maré. *Empire Survey Review,* Vol. 14, No. 103, January 1957. (Offers method to generalize formulae based on the Southern Astronomical Triangle.)

THE NUMBER OF CONDITIONAL EQUATIONS REQUIRED FOR THE ADJUSTMENT OF A TRIGONOMETRICAL NET. Dr. Bogomil Cvetkov. *Empire Survey Review,* Vol. 14, No. 103, January 1957. (Mathematical discussion with formulae.)

APPLICATION OF SHORAN TO ESTABLISH HORIZONTAL CONTROL FOR PHOTOGRAMMETRIC MAPPING OF INACCESSIBLE AREAS. Dr. J. M. Zarzycki. *The Canadian Surveyor,* Vol. 13, No. 6, January 1957. (Describes methods and equipment employed and progress made, in recent years, in establishing control in northern and northwestern Canada.)

AZIMUTH DETERMINATION BY ASTRONOMIC TRANSIT. R. K. C. Johns. *The Canadian Surveyor,* Vol. 13, No. 6, January 1957. (Describes new method and enumerates its advantages.)

SIZE AND SHAPE OF THE EARTH. W. A. Heiskanen. *Science,* Vol. 125, No. 3247, 22 March 1957. (Report on a symposium on the subject, supported and participated in by leading scientific agencies, held at St. Louis University in November 1956.)

DETERMINATION OF THE ACCURACY OF AERIAL STEREOPHOTOGRAMMETRY. B. Hallert. *The Photogrammetric Record,* Vol. 2, No. 9, April 1957. (Describes test procedure treated from the point of view of fundamental operations.)

CONVERGENT OBLIQUES IN ANALYTICAL AERIAL TRIANGULATION. Professor E. H. Thompson. *The Photogrammetric Record,* Vol. 2, No. 9, April 1957. (Describes a method of aerial triangulation with convergent obliques that depends upon a computational rectification of the obliques through their nominal tilts and then proceeding as if the photographs were verticals.)

RIGOROUS GEOMETRICAL CONDITIONS IN AERIAL TRIANGULATION. D. W. G. Arthur. *The Photogrammetric Record,* Vol. 2, No. 9, April 1957. (Mathematical discussion.)

Education

A SUGGESTED BASIC TRAINING COURSE AND SYLLABUS OF EXAMINATIONS FOR LAND SURVEYING STUDENTS. J. H. Holloway. *The Canadian Surveyor,* Vol. 13, No. 5, October 1956. (Describes an attempt to establish a standardization of training methods and examinations.)

Instruments

THE CALIBRATION OF AERIAL SURVEY CAMERAS. G. A. Bell and I. F. Mayer. *Cartography* (The Australian Institute of Cartographers, Kelvin Hall, 55 Collins Place, Melbourne, Victoria, Australia), Vol. 1, No. 4, September 1956. (Discussion of procedures.)

. A NEW METHOD OF COLLIMATION WITH A THEODOLITE. P. Richardus. *Cartography,* Vol. 1, No. 4, September 1956. (Describes results of long experimentation leading to a new method.)

STEPS IN THE DEVELOPMENT OF A MAPPING INSTRUMENT. S. G. Gamble. *The Canadian Surveyor,* Vol. 13, No. 5, October 1956. (Describes steps in development of the "Plane Table Plotter.")

THE GEODIMETER AND ITS USES. B. P. Lambert, Director of National Mapping, Canberra, A.C.T. *The Australian Surveyor,* Vol. 16, No. 4, December 1956. (Detailed discussion of the geodimeter and its uses, with numerous diagrams and half-tone illustrations, and a bibliography of previous literature on the instrument.)

REDUCTION OF ANEROID READINGS. V. Rangan, Survey of India. *Empire Survey Review,* Vol. 14, No. 103, January 1957. (Compares assumptions pertaining to temperature and humidity corrections to aneroid barometer readings and presents tables based on two different mean temperature determinations.)

THE USE OF SENSITIVE PRESSURE DEVICES IN SURVEYING. Desmond O'Connor. *Empire Survey Review,* Vol. 14, No. 103, January 1957. (Is-

sue contains Part I "Main Principles and Considerations" pertaining to atmospheric pressure and its determination. A later issue will contain Part II "Field and Office Procedures" followed by descriptions of the most precise microbarometers now in use.)

Property Surveys

TITLE SEARCHING. A. McF. Limerick. *The Canadian Surveyor,* Vol. 13, No. 5, October 1956. (Interesting general discussion of the problems involved, especially in the Province of New Brunswick, contained in a paper presented at the annual meeting of the New Brunswick Land Surveyors, January 1956.)

DEVELOPMENT OF SURVEYING IN JAMAICA. A. J. Butterfield. *The Canadian Surveyor,* Vol. 13, No. 5, October 1956. (Conclusion of an article begun in the January issue and referred to in the July–September 1956 issue of SURVEYING AND MAPPING.)

CITY SURVEYING BECOMES SIMPLIFIED. Francis P. Ryan. *The Canadian Surveyor,* Vol. 13, No. 5, October 1956. (Describes savings in time and personnel by using a Wild T-2 theodolite instead of a transit and a subtense bar instead of the chaining method, etc. Reprinted from *The American City,* July 1955.)

CADASTRAL SURVEYS IN THE MIDDLE EAST. H. G. Dawe. *The Canadian Surveyor,* Vol. 13, No. 6, January 1957. (Describes obstacles met and largely overcome in conducting a photogrammetric cadastral survey of the Hashemite Kingdom of Jordan.)

Topographic Surveys

IMPRESSIONS OF THE 1956 STOCKHOLM CONGRESS OF THE INTERNATIONAL SOCIETY OF PHOTOGRAMMETRY. W. Schermerhorn. *Photogrammetria,* Vol. 8, 1956–57, No. 1. (Comprehensive summary of results.)

SOME PHYSICAL ASPECTS OF THE INSHORE ENVIRONMENT OF THE COASTAL WATERS OF THE UNITED STATES AND MEXICO. Richard H. Fleming and F. E. Elliott. *The Geographical Journal,* Vol. 122, Part 4, December 1956. (Discussion of the physical characteristics of the land-sea relationship.)

MAPPING THE ISLAND OF NEWFOUNDLAND. S. G. Gamble. *The Canadian Surveyor,* Vol. 13, No. 6, January 1957. (An account of progress in mapping the area since 1935.)

BOOKS AND PAMPHLETS

ROSTER OF REGISTERED ENGINEERS AND LAND SURVEYORS, 1956. (Alabama) Board of Registration for Professional Engineers and Land Surveyors, Montgomery, 1956. 74 pp.

INDIANA, BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS AND LAND SURVEYORS. 34th Annual Report for the Year Ending June 1955. Copy of Registration Law, By Laws and Bulletins of the Board and Roster of Registered Engineers and Land Surveyors for the year ending July 31, 1956. Indianapolis, Bureau of Public Print, 1956. 129 pp., illus.

MAP READING. U.S. Department of the Army, Washington, G.P.O., 1956. 253 pp. (FM 21–26; FM 21–25; FM 21–26, 1944, and FM 21–35.)

ANTARCTICA IN THE GEOPHYSICAL YEAR. Geophysical Monograph No. 1, American Geophysical Union, Publication No. 462, 1956. American Geophysical Union, 1515 Massachusetts Avenue, N.W., Washington 5, D.C. 133 pp., maps, diagrams, and large folded maps in end pocket.

ROUTE SURVEYS AND CONSTRUCTION. (Third edition of *Route Surveys*). Harry Rubey. The Macmillan Company, 60 Fifth Avenue, New York 11, N. Y. 1956. Pocket size, 597 pp., $6.25.

LECTURES ON ROCK MAGNETISM. Prof. P. M. S. Blackett. (Second Weizmann Memorial Lecture, 1954.) Interscience Publishers, Inc., New York. iv and 131 pp. $5.00.

THEODOLITE DESIGN AND CONSTRUCTION. Edward Wilfred Taylor. 2d edition. York (England), Cooke, Troughton, and Simms, Ltd. 1955. 136 pp.

REPORT OF THE FIFTH ANNUAL TEXAS SURVEYORS ASSOCIATION SHORT COURSE. Texas Surveyors Association, Austin, 1956. 85 pp., illustrations, diagrams. (Contains eleven papers presented at the course and of special interest to land surveyors.)

FOREIGN MAPS. U. S. Department of the Army. Washington, G.P.O., 1956. 270 pp. (TM 5-248.)

STAGES AND DISCHARGES OF THE MISSISSIPPI RIVER AND ITS OUTLETS AND TRIBUTARIES, 1955. Mississippi River Commission, Corps of Engineers, U. S. Army. Vicksburg, Mississippi (n.d.) xvii and 281 pp. For sale by Mississippi River Commission, Box 80, Vicksburg, Mississippi, $1.00.

ENGINEERING AS A CAREER. Ralph J. Smith. McGraw-Hill, New York, 1956. 365 pp., illus. $4.75.

REGISTERED PROFESSIONAL ENGINEERS AND LAND SURVEYORS AND CORPORATIONS REGISTERED FOR THE PRACTICE OF PROFFESSIONAL ENGINEERING AND LAND SURVEYING BETWEEN MAR. 1, 1955, AND MAY 4, 1956. University of the State of New York Bulletin No. 1441, Albany, 1956, 55 pp.

MAKING A STATE; FORMATION OF WEST VIRGINIA, INCLUDING MAPS, ILLUSTRATIONS, PLATS, GRANTS, AND THE ACTS OF THE VIRGINIA ASSEMBLY AND THE LEGISLATURE OF WEST VIRGINIA CREATING THE COUNTIES. Edgar B. Sims. Charleston, Mathews Printing and Lithographing Co., 1956, 213 pp., illus. (Published by the State of West Virginia.)

THE WORLD OF RAND MCNALLY. Andrew McNally, 3rd. New York, Newcomen Society in North America, 1956. 28 pp.

A DESCRIPTION OF ORDNANCE SURVEY SMALL SCALE MAPS. Great Britain, Ordnance Survey, Chessington, Surrey, 1957. 12 pp., 17 maps.

CARTOGRAPHY. Hubert A. Bauer. Bellman Publishing Co., Cambridge, Mass. 1957. 32 pp. maps. (Vocational and Professional Monographs No. 60.) $1.00.

THE HAVEN-FINDING ART; A HISTORY OF NAVIGATION FROM ODYSSEUS TO CAPTAIN COOK. E. G. R. Taylor. New York, Abelard-Schuman, 1957. 295 pp., maps.

REPORT OF THE FORTY-FIRST NATIONAL CONFERENCE ON WEIGHTS AND MEASURES. Washington, G.P.O., 1957. 190 pp. Available from Government Printing Office at 70 cents per copy.

THE MAIN PROBLEM OF GEODESY AND THE INVERSE PROBLEM SOLVED BY VECTOR METHODS. C. J. Lehn. København, Bianco Lunos bogtrykkeri a/s, 1957. 47 pp. (Geodaetisk Institute Skrifter 3. Raekke bd. 26.)

—LYMAN D. LYNN
Coast and Geodetic Survey

DISTINCTIVE RECENT MAPS

A map showing *Races of the World* (Menneskeracer) was published in 1955 by Geodaetisk Institute of Denmark, Copenhagen. At the scale of 1:25,000,000 the map shows distributions for some 30 racial groups. It is printed on two sheets each measuring approximately 47 by 33 inches.

Le Petrole Dans Le Monde, a colorful petroleum map of the world, was published in 1956 by Union de Chambres Syndicales de l'Industrie du Petrole, 16 Avenue Kleber, Paris 16, France. It shows principal oil fields, petroleum production by regions, potential petroleum areas, and major export channels. There are enlarged inset maps of Venezuela, the United States, and the Middle East, as well as graphs showing "Production of crude petroleum in 1954" and "Evolution of principal sources of world energy." The map with insets, measures 36 by 45 inches. No scale is given.

A map showing *The Distribution of Indians in the United States* (1950) was copyrighted in December 1956 by Sol Tax. This black and white preliminary edition "was prepared for purposes of discussion at the American Anthropological Association meeting, December 1956, to accompany a paper by Sol Tax, University of Chicago." It was compiled by Samuel Stanley and Robert Thomas, and drafted by Myron Rosenberg.

Indian population by groups, is given numerically on the face of the maps. On the verso there is a "breakdown of population distribution by States showing total population for each State with number of population units contained therein." The map measures 12 by 21 inches.

Cape Cod, ever a favorite of pictorial cartographers, is presented in decorative detail by Clara K. Chase. Published in 1955 by Atlantic Card Company of North Abingdon, Mass., *A Picture Chart of Cape Cod Martha's Vineyard and Nantucket* colorfully portrays this historic and recreational corner of New England. It is 23 by 17 inches in size and at the approximate scale of 1:170,000.

James Bier has compiled and drafted a new map showing *Landforms of Illinois*, which was published in 1956 by the Illinois State Geological Survey, Urbana. The map, which is based primarily on U.S.G.S. quadrangles, portrays landscape features by perspective sketching after the technique perfected by A. K. Lobeck and Erwin Raisz. It is at the scale of 1:1,000,000 and measures 26 by 15½ inches.

Carta Geologica de la Republica Mexicana is a colorful two-sheet geologic map of our southern neighbor. It was presented at the twentieth International Geological Congress which convened in Mexico City in 1956. The scale is 1:2,000,000 and each sheet measures 44 by 22 inches. Some 16 geological formations ranging from Paleozoic to Pleistocene are mapped.

A two-sheet map of Great Britain entitled *Local Accessibility* shows "the hinterlands of towns and other centres as determined by an analysis of bus services." Each sheet measures 32 by 40 inches and the scale is 1:625,000. The map was compiled by the Ministry of Housing and Local Government from information supplied by bus operators and the Ministry of Transport and Civil Aviation. It was published in 1955 by the Director General of the Ordnance Survey, Chessington, Surrey.

The detailed distribution of population in Norway (*Bosettingskart over Norge*) is shown on a 15 sheet map, at the scale of 1:400,000. Published in 1955 by Statistik Sentralbyrå, Oslo, the map is based on the 1950 census statistics. Rural distribution is shown by symbols having values

of 25 to 275 persons. Spheres of graduated sizes indicate population of cities. The individual sheets measure 17½ by 23 inches. The map is accompanied by a sheet which includes title, index map, and legend.

Mapa Samochodowa Polski shows the current transportation network of Poland. It was published in Warsaw in 1956 by Centralny Urzad Geodezji i Kartografi. Two classes of railroads and three classes of roads are shown. Distances in kilometers are given between junction points along highways. The map measures 29 by 31 inches. No scale is given.

Mapa Komunikacyjna Polski shows the communications network of modern Poland. It was issued in 1956 by the same agency. The scale is 1:1,000,000 and the dimensions 28 by 33 inches.

Eisenbahnen in der Bundesrepublik Deutschland shows the complex railroad-transportation network of Western Germany. The map was compiled by Hauptverwaltung der Deutschen Bundesbahn, Frankfurt (Main), and published in 1956 by Georg Westermann, Braunschweig. It is at the scale of 1:750,000 and measures 51 by 34½ inches.

A climatic-growing season map of southwestern Germany (*Wuchsklimakarte Südwestdeutschland Baden-Württenberg*) has been compiled by Dr. H. Ellenberg, with the collaboration of Charlotte Ellenberg, Dr. M. Kohlmeyer, and Dr. Otti Zeller. The map, at the scale of 1:200,000, was published in 1955 by Reise- und Verkehrsverlag, Stuttgart. Twelve different climatic regions are delimited, each identified with a specific product or association of products. The map is in two parts each of which measures approximately 31 by 47 inches. Each sheet has a slight overlap at the junction side.

The U.S. Geological Survey and the Arabian American Oil Company have joined forces to compile a map of Saudi Arabia at the scale of 1:500,000. Prepared under the joint sponsorship of the Kingdom of Saudi Arabia and the U.S. Department of State, the new map is issued in the Geologic Survey's Miscellaneous Geologic Investigations series. The Southern Tuwayq Quadrangle, published in 1956, is the first of some 20 projected sheets. It is issued in two sheets: Sheet A, showing geology and geography, and Sheet B, which shows only geography. The former measures (with marginal data) 42 by 42 inches, and the latter measures 40 by 33½ inches. Both maps are based on surveys by Richard A. Bramkamp, Ruel D. Gierhart, Glen F. Brown, and Roy O. Jackson. Text, legend, and place names are in Arabic and English.

Carte Pluviometrique du Liban, compiled by J. Rey, shows the annual rainfall distribution for the Lebanese Republic. It was published by the Ministère des Travaux Publics, Ksara, Liban, in 1955. The map, which is at the scale of 1:200,000, delimits 8 rainfall zones by means of isohyets and color. A 26-page descriptive booklet on the climate of Lebenon (in French) accompanies the map. Measurements of the latter are 37½ by 27½ inches.

An *Illustrated Map of Iraq* was published recently by the Development Board and Ministry of Development of that Middle East country. It was compiled and drawn by A. Karim Rifaat and printed by the Survey Press of Baghdad. Place names and legend are in English and Arabic. Pictorial sketches of native and domestic animals, economic products, scenic and historic sites, and oil fields are shown. The road, rail, and air networks are laid out on a small inset. The main map measures 24 by 22½ inches and is at the approximate scale of 1:1,700,000.

The *Tribal Map of India* shows distribution, by names overprinted on the map, of some 250 tribal groups. It was prepared by the Department of Anthropology, Government of India, and published at Calcutta in 1956. The scale is 1:3,000,000 and the size 27½ by 27½ inches.

A *Highway Map of Ethiopia*, prepared by the Imperial Highway Authority, Addis Ababa, was published in 1956 in commemoration of the 25th anniversary of the coronation of the Emperor. The map, which was lithographed by A. Hoen & Co. of Baltimore, Md., shows two classes of roads, trails, railroads, national and provincial boundaries, airfields, and distances between towns in kilometers. The scale is 1:2,000,000 and the measurements 35 by 36 inches.

A map of Sierra Leone, at the scale of 1:500,000, showing *Chiefdom Boundaries*, is a 1956 publication of Surveys and Lands Department, Sierra Leone. The map, which is uncolored, shows international, provincial, district, and chiefdom boundaries, as well as cities and towns, railroads, and roads. The map measures 31 by 27½ inches.

A revised edition of a physical map of *Uganda Protectorate* was published in 1956 by the Survey, Lands and Mines Department of the Protectorate. It is at the scale of 1:500,000 and is printed on four 27- by 27-inch sheets. In addition to a generalized representation of relief, the map shows administrative boundaries, several classes of roads, railroads, air fields, telegraph lines, and several categories of populated centers.

Geological Map of the Union of South Africa is a 1955 publication of the Geological Survey, Department of Mines, Pretoria. At the scale of 1:1,000,000, the map is printed on four sheets, each of which measures 28 by 38 inches. Some 36 different formations ranging from Archeozoic to Cenozoic are identified.

—WALTER W. RISTOW
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Books in Review

2525 REVIEW QUESTIONS FOR SURVEYORS. Russell C. Brinker, Head, Department of Civil Engineering, Virginia Polytechnic Institute, Blacksburg, Va., 1956. 200 pages. $3.50.

This is the Fifth Edition of Professor Brinker's review questions for surveyors. These questions are arranged in twelve chapters under the heading of elementary surveying and thirteen chapters under the heading of advanced surveying. This arrangement permits the reader to select the phase of surveying in which he is interested and to find all the questions regarding that branch of surveying in one chapter. The questions have been obtained from various sources. Many are questions used by Professor Brinker and his colleagues in their teaching, and others have been contributed by many other professors.

These questions cover problems in all types of surveying and their related fields. Some are simple, many are thought provoking while some are meant to be amusing. Over 1,300 of the questions have answers tabulated so that the reader can work these problems and check for the right answers. Not only will a study of these questions serve as a review, but the book itself will serve as a supplement to a standard surveying textbook, and also might be considered as material for the "Land Surveyors Handbook" being compiled by the Property Surveys Division of the American Congress on Surveying and Mapping.

There is also a chapter devoted to Sample Registration Examinations. These are professional registration and/or civil service examinations from various States. They are especially valuable to would-be professional land surveyors. No answers are given for the questions in this chapter.

There is an appendix which lists suggested surveying abbreviations, symbols, and hand signals, and also a list of references.

Perhaps one criticism of the book would be that answers should be given for all the questions, in particular, for the Registration Examinations. This would be very desirable but is probably not feasible because of space limitations.

WALTER D. SUTCLIFFE
DRAPER K. SUTCLIFFE

National Atlas of the United States

The National Academy of Sciences–National Research Council, Washington, D. C., has released a processed publication bearing the title "Preliminary List of Desirable Maps for the National Atlas of the United States" and which contains the recommendations of the Committee on a National Atlas of the United States. The explanatory matter preceding the list is as follows:

"A preliminary list of maps suitable for inclusion as loose-leaf sheets of the National Atlas of the United States is presented in the hope of encouraging preparation of additional maps for the Atlas, and also to serve as a reminder of the National Atlas Project. Comments will be welcome as to the suitability for the Atlas of the maps listed.

"The list contains primarily maps which agencies represented on the Committee on a National Atlas thought they might contribute at some time, plus a few additional maps that could be prepared from available information without great compilation cost.

"The list is by no means exhaustive. We cannot foresee all the useful maps that may someday be prepared for the Atlas. Since the Atlas is loose-leaf, we do not need to.

"It is planned to revise the list from time to time. Your suggestions concerning it are invited.

"For the recommended specifications for the National Atlas see "Map Standardization for a Loose-Leaf National Atlas," National Academy of Sciences–National Research Council, Washington, D. C., 1955."

The list contains approximately 135 items suggested for inclusion in the National Atlas, grouped under the following fourteen subject headings: Topography and Planimetry, Water Resources, Geology and Mineral Resources, Soils, Climate, Land Use and Ownership, Forests and Forestry, Agriculture, Parks and Recreation, Transportation, Communications, Population, Manufacturing Industry, and Historical.

Some of the suggested maps have already been prepared, some are now in process, and others are yet to be produced in the future.

The letter transmitting this publication was addressed to "Agencies that regularly or occasionally issue maps showing resources, facilities, production and distribution data, and other physical and cultural information." However, because comments and suggestions are invited, it would seem logical to assume that others seriously interested in the National Atlas Project might secure copies of the publication on application to the National Academy of Sciences–National Research Council, Division of Earth Sciences, 2101 Constitution Avenue, Washington 25, D. C.

MAP INFORMATION

This department was inaugurated for the purpose of bringing to the attention of the members information pertaining to the availability of maps, surveys, etc., with particular emphasis on how such material can be procured. It is believed that through an interchange and dissemination of such information maximum benefits will accrue to the surveying and mapping profession.

—EDITOR

Topographic Maps

THE FOLLOWING quadrangle maps were published by the U. S. Geological Survey between December 1, 1956, and February 28, 1957. The list includes newly compiled maps; revised maps on which contours and drainage usually are unchanged but the works of man are brought up to date; and series-converted maps which are 15-minute maps produced from four 7½-minute maps of the same area. The maps are new unless otherwise designated by numerical superscript.

The quadrangle name (in capital letters) is followed by the name of the county (in upper- and lower-case letters) that contains the place or feature for which the quadrangle is named.

All maps are available with or wthout the green overprint that indicates woodland. These maps show the shape and elevation of the land surface (represented by contour lines, printed in brown); water features (in blue); works of man, including cities, towns, and scattered habitations, schools, churches, railroads, roads and boundaries, place and feature names (in black); and woodland areas (in green). Principal roads are shown by a red overprint. In areas that have been covered by Bureau of Land Management surveys, township and section lines are shown. The State rectangular coordinate systems are indicated in the margins of the maps. An information folder further describing topographic maps is available on request.

Standard quadrangle maps may be obtained for 30 cents per copy. A discount of 20 percent is allowed on orders amounting to $10 or more at the retail price; a discount of 40 percent is allowed on orders amounting to $60 or more. Orders should be addressed to the U. S. Geological Survey, Washington 25, D. C., (or Denver 15, Colo., for maps of areas west of the Mississippi River).

* Indicates 15-minute quadrangle; all others are 7½-minute quadrangles.
¹ Indicates a revised map.
² Indicates a series-converted map.
† Indicates availability in either a contour or a shaded relief edition.
‡ Indicates preliminary black and white edition.

Alaska

SITKA (C–1)*—First Judicial Division
SITKA (C–2)*—First Judicial Division
SITKA (C–3)*—First Judicial Division
SITKA (D–4)*—First Judicial Division
SITKA (D–6)*—First Judicial Division

Arizona

‡ADAMANA 1 NW—Apache
‡ADAMANA 1 SW—Apache
‡ADAMANA 3 NE—Apache
‡ADAMANA 3 SE—Apache
‡ADAMANA 4 NE—Apache
‡ADAMANA 4 NW—Apache
‡ADAMANA 4 SE—Apache
‡ADAMANA 4 SW—Apache
PETRIFIED FOREST *¹—Apache
PINE*¹—Gila
PROMONTORY BUTTE*¹—Gila

Arizona-California

LAGUNA*—Yuma

Arkansas-Missouri

MANILA*¹—Mississippi

Arkansas-Tennessee

JERICHO*¹—Crittenden

California

ARVIN—Kern
BELRIDGE¹—Kern

BIG BASIN—Santa Cruz
BLACK ROCK MTN.*—Trinity
BLUE CANYON—Placer
BUTTONWILLOW[1]—Kern
CASTLE ROCK RIDGE—Santa Clara
COAL OIL CANYON—Kern
DUBAKELLA MTN.*—Trinity
DUNSMUIR*—Siskiyou
DWINNELL RESERVOIR*—Siskiyou
EMERSON LAKE*—San Bernardino
EYLAR MOUNTAIN—Santa Clara
FAIR OAKS*[2]—Sacramento
GRAZA PEAK[1]—Kings
HACIENDA RANCH[1]—Kings
HACIENDA RANCH NW[1]—Kings
HEALDSBURG—Sonoma
ISABEL VALLEY—Santa Clara
LA HONDA—San Mateo
LOST HILLS[1]—Kern
LOST HILLS NW[1]—Kern
MINDEGO HILL—San Mateo
MUSTANG PEAK—Stanislaus
NORDEN—Nevada
PICKETT PEAK*—Trinity
RIO BRAVO[1]—Kern
RODMAN MOUNTAINS*—San Bernardino
SAN VICENTE RESERVOIR—San Diego
SHADOW MOUNTAINS—San Bernardino
SHADOW MOUNTAINS SE—San Bernardino
SIERRAVILLE*—Sierra
SODA SPRINGS—Nevada
TEJON HILLS—Kern
TUPMAN[1]—Kern
TWENTYNINE PALMS*—San Bernardino
WATSONVILLE EAST—Santa Cruz
WEED*—Siskiyou
WEED PATCH—Kern
WESTWOOD*—Lassen
YREKA*—Siskiyou

California-Nevada
BIJOU—El Dorado

Colorado
BOETTCHER LAKE—Jackson
BUFFALO PASS—Routt
COLLBRAN—Mesa
DAVIS PEAK—Jackson
HOWARDSVILLE—San Juan
INDEPENDENCE MOUNTAIN—Jackson
LAKE JOHN—Jackson
MOUNT ETHEL—Routt
MOUNT ZIRKEL—Jackson
OPHIR—San Miguel
PEARL—Jackson
RED ROCK CANYON—Montrose
THE MEADOWS—Mesa
WESTCLIFFE—Custer

Colorado-Wyoming
OLD ROACH—Laramie

Connecticut
LITCHFIELD[1]—Litchfield
SOUTHINGTON[1]—Hartford
THOMASTON[1]—Litchfield
WATERBURY[1]—New Haven

Connecticut-Rhode Island
EAST KILLINGLY[1]—Windham
THOMPSON[1]—Windham

Delaware
GREENWOOD—Sussex
MILTON—Sussex

Delaware-Maryland
BURRSVILLE—Caroline
HICKMAN—Kent

Florida
BEREAH—Polk

Georgia
BOLTON—Fulton
CHAMBLEE—De Kalb
EAST POINT—Fulton

Hawaii
OLOWALU—Maui
WAILUKU—Maui

Idaho
BALDY KNOB—Bingham
BOISE NORTH—Ada
CHRISTMAS MTN.—Ada
COYOTE BUTTE—Ada
LINCOLN CREEK—Bingham
ORCHARD—Ada
ROCKFORD—Bingham
ROSE—Bingham
SPRINGFIELD—Bingham

Illinois-Indiana
HUMRICK—Vermilion
SCOTTLAND—Edgar

Indiana
ANOKA—Cass
BIPPUS—Huntington
BROWNSVILLE—Union
CEDAR GROVE—Franklin
COLUMBIA CITY—Whitley
CRAWFORDSVILLE — Montgomery
DANA—Vermillion
EGE—Noble
MARTINSVILLE—Morgan
MOORESVILLE EAST—Morgan
ROCKVILLE—Parke
RUSSELLVILLE—Putnam

Iowa-Illinois
DUBUQUE SOUTH—Dubuque

Kansas
STILWELL—Johnson

Kentucky
BENTON*[2]—Marshall
HICKORY*[2]—Graves
JEFFERSONTOWN[1]—Jefferson

Kentucky-Indiana
LOUISVILLE WEST[1]—Jefferson

Kentucky-Ohio
COVINGTON—Kenton
NEWPORT—Campbell

Kentucky-Tennessee
MAYFIELD*[2]—Graves
MURRAY*[2]—Calloway

Louisiana
CHOPIN*[1]—Rapides
LAFAYETTE—Lafayette
LAKE CHARLES—Calcasieu
OPELOUSAS*[1]—St. Landry
WESTLAKE—Calcasieu

Maine
BOYD LAKE*[1]—Piscataquis
ORLAND*[1]—Hancock
SMYRNA MILLS*[1]—Aroostook

Maryland-Virginia
POINT OF ROCKS[1]—Frederick

Massachusetts
BLANDFORD[1]—Hampden
GREENFIELD[1]—Franklin
MT. TOBY[1]—Franklin

Michigan
CHAMPION—Marquette
CHAMPION*—Marquette
CHANNING—Dickinson
COMINS*—Oscoda
DIORITE—Marquette
GREENWOOD—Marquette
MARENISCO—Gogebic
RALPH*—Dickinson
RALPH NE—Dickinson
REPUBLIC*—Marquette
REPUBLIC—Marquette
REPUBLIC SW—Marquette
VULCAN—Dickinson
WAKEFIELD—Gogebic
WAKEFIELD NE—Gogebic
WITCH LAKE*—Marquette

Michigan-Wisconsin
MARENISCO*—Gogebic
RANDVILLE—Dickinson
WAKEFIELD*—Gogebic

Minnesota
CIRCLES PINES—Anoka
CRAMER*—Lake
HIGH FOREST*—Olmsted
ISANTI*—Isanti
OSSEO—Hennepin
SCHROEDER—Cook
TOFTE—Cook

Minnesota-Wisconsin
FOREST LAKE*—Washington

Missouri
DADEVILLE—Dade
EVERTON—Dade

Nebraska
CUSHING—Howard

New Jersey
CAPE MAY—Cape May
CHATHAM[1]—Morris
HIGH BRIDGE[1]—Hunterdon
WANAQUE[1]—Passaic

New Jersey-New York
KEYPORT[1]—Monmouth
SANDY HOOK[1]—Monmouth

New Mexico
ABIQUIU*[2]—Rio Arriba
AGUA FRIA*[2]—Sante Fe
TIJERAS—Bernalillo
TORREON*—Torrance

New York
AMITYVILLE[1]—Suffolk
BAY SHORE WEST[1]—Suffolk
BLUE MOUNTAIN*—Hamilton
CHAUTAUQUA—Chautauqua
CLYMER—Chautauqua
CORTLAND[1]—Cortland
DUNKIRK—Chautauqua
FAR ROCKAWAY[1]—Queens
FULTON—Oswego
HAMLET—Chautauqua
HARTFIELD—Chautauqua
HOLLAND—Erie
INDIAN LAKE*—Hamilton
JAMESTOWN—Chautauqua
JAMESVILLE[1]—Onondaga
LAKE PLACID*—Essex
LAKEWOOD—Chautauqua
LONG LAKE*—Hamilton
NORTH CLYMER—Chautauqua
OLD FORGE*—Herkimer
ONEIDA[1]—Madison
PANAMA—Chautauqua
POINT ROCK[1]—Oneida
SHERMAN—Chautauqua
TEXAS—Oswego
THIRTEENTH LAKE*—Warren
WEST OF TEXAS—Oswego

North Dakota
FULLERTON SE—Dickey
GUELPH—Dickey
LAKE UPSILON SW—Rolette
LA MOURE—La Moure
MEDINA SE—Stutsman
MEDINA SW—Stutsman
RANGELEY NW—McHenry
ROLETTE SW—Rolette
THORNE—Rolette

Ohio
DAYTON NORTH—Montgomery
DAYTON SOUTH—Montgomery
FAIRBORN—Greene
GALLOWAY—Franklin
GREENHILLS—Hamilton
HAMILTON—Butler
MONROE—Butler

REYNOLDSBURG—Franklin
SHANDON—Butler
SHAWNEE HILLS—Union
SOUTHWEST COLUMBUS—Franklin

Oklahoma

ENID EAST—Garfield
ENID WEST—Garfield
JONES—Oklahoma

Oregon

CANBY—Clackamas
GLIDE*—Douglas
GRANTS PASS*—Josephine
LINNTON—Multnomah
NEWBERG—Yamhill
OSWEGO—Clackamas
SANDY—Clackamas
SHERWOOD—Washington
YODER—Clackamas

Oregon-Washington

PORTLAND—Washington
ST. HELENS—Columbia

Pennsylvania

BERNVILLE—Berks
CONESTOGA—Lancaster
CONYNGHAM[1]—Luzerne
FLEETWOOD—Berks
MILLERSBURG*[1]—Dauphin
QUARRYVILLE—Lancaster
SAFE HARBOR—Lancaster
SINKING SPRING—Berks
STRAUSSTOWN—Berks
WEST YORK—York
WOMELSDORF—Berks
YORK—York

Pennsylvania-New Jersey

LUMBERVILLE[1]—Bucks

Puerto Rico

AGUAS BUENAS[1]—Aguas Buenas

Rhode Island

SAKONNET POINT[1]—Newport

Rhode Island-Massachusetts

BRISTOL[1]—Bristol

South Dakota

BRIDGER—Ziebach
BRIDGER SE—Ziebach
CICERO PEAK—Custer
HILLAND NW—Haakon
HOWES—Meade
PEDRO—Pennington
PEDRO SE—Pennington
RATTLESNAKE LAKE—Ziebach
RATTLESNAKE LAKE NE—Ziebach
RATTLESNAKE LAKE SE—Ziebach
RATTLESNAKE LAKE SW—Ziebach

Tennessee

ALPINE—Overton
BALD KNOB—Van Buren

Tennessee-Missouri-Kentucky

REELFOOT LAKE*[1]—Lake

Texas

ALGERITA—San Saba
ALMEDA[1]—Harris
BAKER SPRING—San Saba
BENBROOK—Tarrant
CARADAN—Mills
CARLTON—Hamilton
CHEROKEE—San Saba
CRANE ISLANDS*[2]—Nueces
CRANFILLS GAP—Bosque
CUTOFF MTN.—Hamilton
EDNA HILL—Erath
EIDSON LAKE—Hamilton
GENTRYS MILL—Hamilton
GERMAN VALLEY—Hamilton
GUSTINE—Comanche
HAMILTON EAST—Hamilton
HAMILTON WEST—Hamilton
HARMASTON[1]—Harris
HICO—Hamilton
HIGHLANDS[1]—Harris
HURST SPRING—Coryell
INDIAN GAP—Hamilton
INDIAN HILLS—San Saba
IREDELL—Bosque
JONESBORO—Coryell
LA COMA[1]—Cameron
LA LEONA[1]—Cameron
LAKE WORTH—Tarrant
LAMKIN—Comanche
LEAGUE CITY[1]—Galveston
LONE GROVE—Llano
MERIDIAN—Bosque
MOSHEIM—Bosque
NEW WILLARD*—Polk
NORTH OF PORT ISABEL*[2]—Cameron
NORTH OF PORT ISABEL SW—Cameron
OHIO—Hamilton
PALMITO HILL[1]—Cameron
PEARLAND[1]—Brazoria
PECAN WELLS—Hamilton
PETRONILA*—Nueces
PILOT KNOB—Bosque
PORT ISABEL[1]—Cameron
PORT ISABEL*[2]—Cameron
PORT ISABEL NW—Cameron
POTRERO LOPENO*[2]—Kenedy
POTTSVILLE—Hamilton
PROCTOR—Comanche
RIVIERA*—Kleberg
SHIVE—Hamilton
SILSBEE*—Hardin
SOUTH OF POTRERO LOPENO*[2]—Kenedy
SPRING CREEK GAP—Bosque
SUGARLOAF MOUNTAIN—Bosque
THREE ISLANDS[1]—Cameron
WOODVILLE*—Tyler

Utah

BRIGHTON—Salt Lake
BURMESTER—Tooele
CAMELS BACK RIDGE NE—Tooele
COYOTE SPRINGS—Tooele
MOUNT AIRE—Salt Lake
PARK CITY EAST—Summit
PARK CITY WEST—Summit
SIMPSON SPRINGS—Tooele
TABBYS PEAK—Tooele
TABBYS PEAK SW—Tooele
WIG MOUNTAIN—Tooele
WIG MOUNTAIN NE—Tooele

Utah-Colorado

LISBON VALLEY*—San Juan

Vermont

WOODFORD—Bennington

Virginia

CHASE CITY*—Mecklenburg
KENBRIDGE*—Lunenburg
RUNNYMEDE—Surry
TOWNSEND—Northampton
WESTCOTT POINT—Northampton

Virginia-Maryland-West Virginia

HARPERS FERRY[1]—Jefferson

Virginia-North Carolina

BOYDTON*—Mecklenburg

Washington

BADGER GAP—Kittitas
BLACK ROCK SPRING—Yakima
BLACK ROCK SPRING NW—Yakima
BOYLSTON—Kittitas
DORIS—Kittitas
EAST KITTITAS—Kittitas
GINKGO—Kittitas
KITTITAS—Kittitas
McDONALD SPRING—Kittitas
SELAH SPRINGS—Yakima
TAHOLAH*—Grays Harbor
WYMER—Kittitas

Washington-Oregon

WASHOUGAL—Clark

West Virginia-Virginia-Maryland

CHARLES TOWN[1]—Jefferson

Wisconsin

APPLETON—Outagamie
APPLETON*—Outagamie
BEAVER DAM*—Dodge
FOND DU LAC—Fond du Lac
FOND DU LAC*—Fond du Lac
FOX LAKE*—Dodge
KEWASKUM*—Washington
NEENAH—Winnebago
NEENAH*—Winnebago

Wisconsin-Iowa

BALLTOWN—Dubuque
CASSVILLE—Grant

Wisconsin-Michigan

IRONWOOD*—Gogebic

Wyoming

BALDY MOUNTAIN—Albany
CANNONBALL CUT—Albany
COOPER LAKE NORTH—Albany
GUIDE ROCK—Albany
INDIA GUIDE—Albany
LAKE IONE—Albany
ROCK RIVER—Albany
SAVAGE RANCH—Carbon
SYBILLE SPRINGS—Albany

In addition to the standard series of quadrangle maps, small-scale (1:250,000) maps of areas in the United States and Territories are being published and distributed. They may be purchased from the Geological Survey for 50 cents per copy. An index to the series is available on request.

Arkansas

LITTLE ROCK
RUSSELLVILLE

Mississippi-Arkansas-Louisiana

GREENWOOD

Tennessee-Arkansas-Missouri

MEMPHIS

Special metropolitan-area and vicincity maps of major United States cities are being published and distributed by the Geological Survey. These maps are prepared from standard 7½-minute maps at the scale of 1:24,000. Vicinity maps may be purchased from the Geological Survey for the prices indicated below.

ALBUQUERQUE AND VICINITY (37 by 38 inches) $1.50.
BATON ROUGE AND VICINITY (37 by 44 inches) $1.50.
LONG BEACH AND VICINITY (43 by 72 inches) $1.50.
LOS ANGELES AND VICINITY EAST (50 by 72 inches) $1.50.

LOS ANGELES AND VICINITY WEST (50 by 72 inches) $1.50.
OAKLAND AND VICINITY (42 by 72 inches) $1.50.
SAN FRANCISCO AND VICINITY (42 by 72 inches) $1.50.
SEATTLE AND VICINITY (42 by 72 inches) $1.50.
WILKES BARRE, PITTSTON AND VICINITY (39 by 45 inches) $1.50.
WORCESTER AND VICINITY (39 by 45 inches) $1.50.

A new United States status map (seventh edition, 1957) has been published showing topographic and planimetric quadrangle maps published at scales ranging from 1:24,000 to 1:250,000 by the Geological Survey and other agencies. A general appraisal of the adequacy of these maps is indicated by color patterns. Scale, 1:5,000,000. Free on application.

Lake Survey Charts

PUBLICATION of new editions of the following Lake Survey Charts has been announced by the United States Lake Survey of the Corps of Engineers, U. S. Army. Copies of these charts may be obtained from the U. S. Lake Survey, 630 Federal Building, Detroit 26, Mich., at 75 cents per copy. Payment is required in advance by P. O. money order or draft, payable to the Treasurer of the United States. A catalog showing the areas described below is available free upon request.

21.—Coast Chart, Clayton, N. Y., and Kingston, Ont., to Stony Point, N. Y., and False Duck Islands, Ont., at 1:80,000 scale. (November 1956)
171.—Lake Champlain—Richelieu River and Missisquoi Bay, Quebec to South Hero Island, Vt., at 1:40,000 scale. (November 1956)
172.—Lake Champlain—Cumberland Head, N. Y., and Savage Island, Vt., to Four Brothers Islands, at 1:40,000 scale. (November 1956)
173.—Lake Champlain—Four Brothers Islands to Barber Point, N. Y., at 1:40,000 scale. (October 1956)
175.—Burlington Harbor, Vt., at 1:10,000 scale. (January 1957)
256.—Lower Niagara River, from Niagara Falls to Lake Ontario, at 1:30,000 scale. (October 1956)
314.—Buffalo Harbor, N. Y., including Black Rock Canal, at 1:15,000 scale. (November 1956)
758.—St. Joseph and Benton Harbor, Mich., at 1:10,000 scale. (January 1957)

Public Land Survey Plats

THE FOLLOWING plats of public land surveys and resurveys were completed and accepted by the Bureau of Land Management between December 1, 1956, and February 28, 1957. The class or purpose of the survey is indicated. Copies of plats may be secured from the Bureau offices in the States or from the Director, Bureau of Land Management, Department of the Interior, Washington 25, D. C.

Alaska—Seward Meridian
T. 11 N., R. 3 W.—Extension survey
T. 19 N., R. 4 W. (2)—Dependent resurvey and subdivision survey

Arizona—Gila and Salt River Meridian
T. 7 N., R. 12 W.—Skeleton survey
T. 8 N., R. 12 W.—Skeleton survey
T. 12 N., R. 12 W.—Skeleton survey
T. 9 N., R. 14 W.—Skeleton survey
T. 8 N., R. 15 W.—Skeleton survey
T. 9 N., R. 15 W.—Skeleton survey
T. 7 N., R. 16 W.—Skeleton survey
T. 8 N., R. 16 W.—Skeleton survey
T. 9 N., R. 16 W.—Skeleton survey
T. 5 N., R. 17 W.—Skeleton survey
T. 22 N., R. 17 W.—Dependent resurvey
T. 23 N., R. 18 W.—Dependent resurvey
T. 28 N., R. 19 W.—Skeleton survey
T. 4 N., R. 20 W.—Skeleton survey
T. 27 N., R. 20 W.—Skeleton survey
T. 28 N., R. 20 W.—Skeleton survey
T. 27 N., R. 21 W.—Skeleton survey
T. 28 N., R. 21 W.—Skeleton survey

California—Mt. Diablo Meridian
T. 16 N., R. 8 W.—Dependent resurvey

Colorado—New Mexico Principal Meridian
T. 36 N., R. 6 W.—Dependent resurvey

Idaho—Boise Meridian
T. 9 S., R. 25 E.—Dependent resurvey

Kansas—Sixth Principal Meridian
T. 7 S., R. 13 W.—Dependent resurvey
T. 6 S., R. 14 W.—Dependent resurvey
T. 7 S., R. 14 W.—Dependent resurvey

Michigan—Michigan Meridian
T. 15 N., R. 8 W.—Island survey

Minnesota—Fourth Principal Meridian
T. 63 N., R. 17 W.—Island survey
T. 64 N., R. 19 W.—Island survey

Montana—Principal Meridian
T. 14 N., R. 55 E.—Island survey

Nebraska—Sixth Principal Meridian
T. 15 N., R. 12 W.—Dependent resurvey
T. 15 N., R. 13 W.—Dependent resurvey
T. 20 N., R. 14 W.—Dependent resurvey
T. 16 N., R. 15 W.—Dependent resurvey
T. 18 N., R. 15 W.—Dependent resurvey
T. 19 N., R. 15 W.—Dependent resurvey
T. 20 N., R. 15 W.—Dependent resurvey

Nevada—Mt. Diablo Meridian
T. 40 N., R. 25 E.—Dependent resurvey and survey
T. 43 N., R. 37 E.—Dependent resurvey
T. 12 N., R. 56 E.—Dependent resurvey
T. 13 N., R. 57 E.—Dependent resurvey
T. 14 N., R. 57 E.—Dependent resurvey
T. 11 N., R. 58 E.—Original survey
T. 13 N., R. 58 E.—Dependent resurvey
T. 16 N., R. 63 E.—Dependent resurvey and survey
T. 17 N., R. 63 E.—Dependent resurvey and survey
T. 17 N., R. 64 E.—Dependent resurvey
T. 6 N., R. 66 E.—Dependent resurvey
T. 4 N., R. 67 E.—Dependent resurvey
T. 5 N., R. 67 E.—Dependent resurvey
T. 19 S., R. 55 E.—Dependent resurvey
T. 19 S., R. 58 E.—Dependent resurvey
T. 19 S., R. 59 E.—Dependent resurvey
T. 19 S., R. 60 E.—Dependent resurvey
T. 16 S., R. 62 E.—Dependent resurvey

New Mexico—New Mexico Principal Meridian
T. 32 N., R. 11 W.—Dependent resurvey
T. 25 N., R. 14 W.—Survey of exteriors
T. 25 N., R. 15 W.—Survey of exteriors
T. 25 N., R. 16 W.—Survey of exteriors
T. 25 N., R. 17 W.—Survey of exteriors
T. 25 N., R. 18 W.—Survey of exteriors
T. 25 N., R. 19 W.—Survey of exteriors
T. 26 N., R. 19 W.—Survey of exteriors
T. 27 N., R. 19 W.—Survey of exteriors
T. 28 N., R. 19 W.—Survey of exteriors

North Dakota—Fifth Principal Meridian
T. 140 N., R. 100 W.—Theodore Roosevelt Memorial Park
T. 140 N., R. 101 W.—Theodore Roosevelt Memorial Park
T. 141 N., R. 101 W.—Theodore Roosevelt Memorial Park
T. 140 N., R. 102 W.—Theodore Roosevelt Memorial Park
T. 141 N., R. 102 W.—Theodore Roosevelt Memorial Park

Washington—Willamette Meridian
T. 31 N., R. 6 W.—Ediz Hook Lighthouse Reserve

Wyoming—Sixth Principal Meridian
T. 41 N., R. 73 W.—Dependent resurvey
T. 15 N., R. 100 W.—Dependent resurvey
T. 16 N., R. 100 W.—Dependent resurvey
T. 55 N., R. 100 W.—Supplemental surveys
T. 15 N., R. 100½ W.—Original survey
T. 16 N., R. 100½ W.—Original survey

Wyoming—Wind River Meridian
T. 3 N., R. 3 E.—Supplemental surveys

Foreign Topographic Mapping Agencies and their Sales and Information Offices

Valid names and addresses of the governmental topographic mapping agencies and sales counters of the following nations may be found listed in SURVEYING AND MAPPING, April–June 1956, Vol. XVI, No. 2, pp. 212–216:

Argentina, Australia, Belgium (as distinct from Belgian Congo), Ceylon, Costa Rica, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Finland, France, Great Britain, Greece, Guatemala, Honduras, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Panama, Philippines, Poland, Sweden, Switzerland, Syria, Turkey, Union of South Africa, Venezuela, West Germany, and Yugoslavia.

In SURVEYING AND MAPPING, October-December 1956, Vol. XVI, No. 4, pp. 506-508:

Austria, Brazil, Burma, Cambodia, Canada, Colombia, Haiti, India, Liberia, Liechtenstein, Mexico, Portugal, and Thailand.

Current additions to the list are as follows:

MAP SALES AND INFORMATION COUNTERS	GOVERNMENT TOPOGRAPHIC MAP AGENCIES
BELGIAN CONGO Institut Géographique du Congo Belge LEOPOLDVILLE/KALINA	Same
CHILE Instituto Geográfico Militar Castro 354 SANTIAGO	Same
INDONESIA Biro Peta2 Djatop A. D. Djalan Budikemulian no. 5 DJAKARTA	Balai Geografi Djalan Dr. Wahidin Satu no. 11 DJAKARTA
IRAQ Directorate General of Surveys (Iraq) BAGHDAD	Same
LAOS Service de Vente Institut Géographique National 107, Rue La Boétie PARIS 8e, France	Mapping program executed by the Institut Géographique National of France.

LEBANON[1] Librairie Antoine Bab-Edriss Rue Emir Bechir BEIRUT	Mapping program executed by the Institut Géographique National of France.
MONACO Service de Vente Institut Géographique National 107, Rue La Boétie PARIS 8e, France	None (*Mapping program executed by the Institut Géographique National of France.*)
MUSCAT & OMAN, SULTANATE OF[2] Messers. E. Stanford Ltd. 12/14 Long Acre LONDON, W.C. 2, England *also*: Messers. Philip, Son & Nephew, Ltd. 7, Whitechapel LIVERPOOL 1, England *and*: Army Map Service 6500 Brooks Lane Washington 16, D. C.	None (*Mapping program executed by the British War Office, of which the address is as follows*: Directorate of Military Survey The War Office LONDON, S.W. 1, England)
PAKISTAN Surveyor General of Pakistan Survey of Pakistan Post Box No. 3906 KARACHI	Same
PERU Instituto Geográfico Militar Apartado 2038 LIMA	Same
SUDAN Director Survey Department KHARTOUM	Same
URUGUAY Servicio Geográfico Militar 8 de octubre 3255	Same
MONTEVIDEO *For departmental maps without altimetry*: Dirección de Topografía del Ministerio de Obras Públicas Piedras 421 MONTEVIDEO	Same
VIET NAM[1] Le Directeur Service Géographique National DALAT	Same
WEST BERLIN Aussenstelle des Instituts für Angewandte Geodäsie Wilhelmstrasse 9 BERLIN SW 68, Germany	Institut für Angewandte Geodäsie Mainzer Landstrasse 147 FRANKFURT a. M., Germany

—WILLIAM HANNAH

[1] Same maps also available at the Institut Géographique National of France.
[2] Subject to availability of stocks, Messers. Stanford of London, Philip of Liverpool, and the U. S. Army Map Service of Washington also carry British War Office maps of AFGHANISTAN, BHUTAN, JORDAN, KUWAIT, NEPAL, SAUDI ARABIA, YEMEN, and of many other areas of the world where maps are otherwise unobtainable. Catalogues are provided on request.

Message from the President Regarding A.S.C.E. Report on Status of Surveying and Mapping

THE FOLLOWING REPORT on the "Status of Surveying and Mapping" appeared in the March 1957 issue of *Civil Engineering*, a publication of the American Society of Civil Engineers. This report, and the recommendations it contains, was submitted to the American Society of Civil Engineers by a task committee of ASCE's Surveying and Mapping Division. As stated near the end of Brother B. Austin Barry's introduction to the report, comments from the ASCE membership have been invited.

Any Action taken or position assumed by ASCE on this subject will be of direct interest to the membership of the American Congress on Surveying and Mapping. It is important, therefore, that ACSM carefully study the recommendations now being considered by ASCE, and (1) insofar as possible develop consolidated opinion or opinions within ACSM regarding both the soundness and timeliness of the proposed ASCE action, and (2) pass on to ASCE our opinions in order that we may assist and influence ASCE in arriving at conclusions that seem most desirable from the standpoint of all concerned.

In April of this year, copies of the report were sent to ACSM Past Presidents, Directors, Advisory Council Members, and Chairmen of Technical Divisions, Standing Committees, and Local Sections, with a request that they give this matter careful thought and submit their comments to the President by August 1, 1957, so that consolidated opinions can be developed and transmitted to ASCE. The several chairmen, who represent groups, were urged to develop and report the opinions of their respective groups insofar as possible. Various affiliated organizations were also sent copies of the ASCE report and invited to submit comments to ASCM if they wished to do so.

The purpose of reprinting the ASCE report in our Journal is to ensure that every member of ACSM who is interested in this matter, but who has not been otherwise informed regarding it, will be so informed and have an opportunity to comment on it before final action is taken by ASCE. Therefore, members of ACSM who wish to make their opinions on this matter known, but are not doing so within the consolidated comments that are being developed by the various chairmen or are not submitting comments directly to ASCE, are invited to submit comments to the President at the address given below. All comments should be in by August 1, 1957, so that they can be summarized and presented to ASCE in a form that will be most usable.

It is regretted that it was not feasible to bring this matter to your attention in an earlier issue of the Journal. The time available for comments is quite short. However, you are urged to give this subject serious attention.

R. H. LYDDAN
President

Room 5236, GSA Building
Washington 25, D. C.

Introduction to Report on Status of Surveying and Mapping

BROTHER B. AUSTIN BARRY, Chairman, Task Committee on Status of Surveying and Mapping

The Task Committee on Status of Surveying and Mapping, appointed by the Surveying and Mapping Division, has been at its study for two years. It aims to achieve a sound basis for proper evaluation of professional relationships.

While surveying in all its aspects has traditionally been identified with civil engineering, in recent years there has been less conscious identification with it despite the expansion of civil engineering into new fields as man discovers, deduces, and devises new areas of exploitation. Land surveying is more evidently separated in the public view, as also in the engineers' view. No longer is it as axiomatic that a land surveyor is a civil engineer, although paradoxically there are probably more civil engineers engaged in land surveying than ever before in history.

Mapping today has achieved a new eminence through the emergence of photogrammetry as a procedure. It is possible now to execute topographic maps at fabulous speed—in months instead of years—with hitherto impracticable accuracy and with great saving. Today it is increasingly uneconomical to omit the use of photogrammetric methods in civil engineering projects.

Both these and still other phases of surveying and mapping have been of concern to the Society because questions of protocol and procedure have been raised in their regard. The determination of ethical procedure in executing surveying work is of necessity based upon proper understanding of the professional status of the activity and of the individuals engaged therein. Competitive-price bidding is just one of the important problems to be resolved in engaging surveying personnel for construction or mapping, as also in the execution of contracts for topographic mapping.

The decision that one or more phases of surveying and mapping are not civil engineering would, of course, remove such work from the purview of the Society. On the other hand, such aspects of surveying and/or mapping as are deemed to be both professional work and civil engineering work must be made to conform to accepted codes of ethics and of professional practice.

The major findings of the study are published here in an attempt to secure wide response on as broad a base as possible. Particular attention is drawn to the tentative finding that Category I (Land Surveying) is not civil engineering.

To make a study of this sort truly representative of prevailing conditions nationally, it is desirable to afford opportunity to the many in all divisions of civil engineering to express their views. Comments are therefore invited from all the membership. The implications are far reaching, for surveying and mapping form the broad base for every branch of civil engineering. [Comments should be sent to Brother B. Austin Barry, A.M. ASCE, Manhattan College, New York, N. Y.]

Interim Report of Task Committee on Status of Surveying and Mapping

(Received by the Executive Committee of the Surveying and Mapping Division, Oct. 18, 1956)

Brother B. Austin Barry, Chairman **Alfred O. Quinn** **George D. Whitmore**

A year ago, on October 24, 1955, the initial report of this Task Committee was presented to the Executive Committee of this Division and was accepted and adopted by them as an official statement of the Division. The report was subsequently published as Proceedings Paper No. 921 in the Journal of the Surveying and Mapping Division, Vol. 82, No. SU1, in March 1956 under the title, "Professional Aspects of Surveying and Mapping." Discussion of the paper was concluded on August 1, 1956, and the discussion has since appeared in the Journal, Vol. 82, No. SU2, in September 1956. A closing discussion by the Task Committee (the authors) will be prepared in the near future for presentation in the pages of the Journal.

The first report ("Phase One" Report) defined "professional," "technician-level," and "pre-professional" tasks in each of six categories of surveying and mapping activities. No attempt was made, however, to ascertain which tasks or which categories were engineering in nature, this being a task beyond the assigned scope of the first phase of the study.

Following the receipt of the October 1955 Report, the Executive Committee directed the Task Committee to proceed without delay to study the next question in order—namely, the determination of which categories of surveying and mapping should properly be construed as engineering and which should be considered non-engineering. This has been the subject of study during the intervening months, and it is now felt that a preliminary statement can be made for presentation at this time. Certain details still remain to be clarified, but the major lines of demarcation are clear. The following paragraphs cover the general disposition of each category without necessarily presenting the entire case for the decision; the fuller presentation at a later date will cite all the reasons therefor, including documents merely mentioned here.

The Task Committee believes that its findings are in conformity with the definitions of Practice of Engineering in the widely accepted Model Law (July 1946) for the Registration of Professional Engineers and Land Surveyors. . . .

Category I—Land Surveying (Cadastral)

The committee believes that it has no choice but to recommend that land surveying be regarded as an activity separate and distinct from engineering, in view of certain official pronouncements, as follows:

(*a*) 1948, National Council of State Boards of Engineer Examiners (NCSBEE) approval of report of its Committee on Land Surveying, which recommended separation of land surveying from engineering.

(*b*) 1952, National Society of Professional Engineers (NSPE) Resolution No. 1-52, endorsing the 1948 NCSBEE report cited above.

(*c*) 1956, NCSBEE approval of report of its Committee on Land Surveying,

which in effect affirms its 1948 position, and spells out in more detail why land surveying should be separate from engineering, as well as what should be included under engineering surveys.

Within the province of the land surveyor is certain land subdivision work in which he shares responsibility with the engineer. For example, the subdivision of land tracts is to be planned by the engineer (such as the fixing of street alinement and grades, sewerage design and grades, drainage design, etc.), while the layout of lots, calculation of plot areas, subdivision of parcels according to a predetermined general plan, and filing of the subdivision plan is the task of the land surveyor.

Category II—Engineering Surveys for Design and Construction

All of the work in this category is widely recognized as engineering. The informational surveying (investigations, and the obtaining of qualitative and quantitative data) for the design and development of engineering projects, as well as producing maps (by photogrammetric and/or ground methods) has always been considered engineering work. Similarly, all surveying layout incident to the construction of such projects is itself engineering.

On the occasions and to the extent that informational or construction surveys require the establishment of property lines or corners, it is to be noted that such location and establishment is to be regarded as land surveying.

Category III—Geodetic Surveying, Geodetic Engineering or Geodesy

Most of the operations within this category (which the Committee will recommend be called Geodetic Engineering) are regarded as engineering, the exception being certain work (e.g., figure-of-the-earth computations) which is strictly geodesy and which may be regarded as non-engineering in nature, albeit scientific and professional.

Category IV—Cartographic Surveying, Cartographic Engineering, or Map and Chart Surveying

The Task Committee believes that the professional work within this category, which the committee recommends be called Cartographic Engineering, must be regarded as engineering, in view of certain official pronouncements, as follows:

(*a*) Resolution dated March 3, 1952, by ASCE Board of Direction, stating that "the planning, execution, and direction of the professional surveying activities that are necessary for the production of the Government's standard series of maps and charts, as well as similar work elsewhere, are professional engineering."

(*b*) The previously mentioned 1948 report approved by NCSBEE, which states that "the surveying necessary for the preparation of a topographic map is engineering surveying and not land surveying."

(*c*) The previously mentioned 1952 Resolution (No. 1-52) of NSPE approving the 1948 NCSBEE statement cited immediately above.

(*d*) The previously mentioned 1956 approved report of the Committee on Land Surveying of NCSBEE which, like the 1948 report, clearly defines topographic surveying and hydrographic surveying as engineering surveying, and specifically excludes them from land surveying.

Furthermore, the Task Committee is under the impression that most of the state boards for registration of engineers consider, and in some cases have specifically ruled, that such work as topographic surveying and mapping is engineering, and therefore must be performed by those in private practice in compliance with the state laws for registration of engineers.

Category V—Aerial Survey Services

Attention is called to the use of photogrammetric means of accomplishing much of the work of Categories I, II, and IV. Category V therefore does not include the entire field of aerial or photogrammetric methods, nor even most of them, but merely certain adjunct services which can be separately considered.

The Task Committee finds that the operations listed within this category are not intrinsically engineering in nature, although any of them could become an important part of an engineering project. (The photogrammetric methods of the preceding four categories are engineering procedures by reason of their being operations of an engineering project, *e.g.*, the preparation of a topographic map.)

Category VI—Cartography (not requiring original surveys)

The operations of this category are deemed to be non-engineering, since they do not conform to the accepted definition of engineering work.

Conclusion

The Task Committee expects to finish its "Phase Two" Report by the spring or summer of 1957. Upon submission to the Executive Committee of the Division of such report, it is expected that except for minor revisions and possible discussion through "Proceedings" that the task of the Committee will be completed.

During this final period of rounding out all aspects of the study, the members are attempting to secure helpful opinions and to foresee areas of confusion so as to guarantee acceptance of the findings with a minimum of friction and delay. There seems to be a fairly uniform nationwide acceptance of the roles of the engineering surveyor and of the land surveyor. In the matter of photogrammetric activity, however, some apparent difference of opinion exists; some resolving of this difference can certainly be worked out, and it is the intention of the Task Committee to work up a fairly detailed and clear statement of its stand on this (and any similar) matter before presenting its final report.

We request comments on this Interim Report that may assist in clarifying the statements or opinions expressed. We are grateful to all those, within and without the Surveying and Mapping Division, for help received in this task.

The tenets used for the differentiation throughout the study are as follows:

Professional Level. Work performed by such a person involves the exercise of professional judgment, frequently based on knowledge acquired through higher learning, generally non-routine in character. The term implies one who can plan, perform, and/or direct all such operations in the category; this person is responsible for work performed by those under him.

Technician Level. Work performed by such a person is primarily routine, of a technical nature, often demanding a higher degree of skill, done under the direction of a professional person who is responsible for its outcome.

Preprofessional Level. Work at the technician level performed by a professional trainee who, having completed courses of specialized intellectual instruction and study, is seeking to attain professional status.

Definitions of Professional Positions

As a guide to the terms used for designating the several professional positions in the preceding outline, it is thought advisable here to include certain definitions. These follow generally the accepted definitions as given in ASCE Manual No. 34, "Definitions of Surveying, Mapping, and Related Terms" 1954, but are altered somewhat to more clearly describe the particular job function envisioned in this outline.

Land Surveyor determines location of land boundaries; prepares map showing shapes and areas of land; divides land into smaller tracts, including layout of roads and streets and rights-of-way to same to give access to smaller tracts; prepares official plats or maps of such land subdivisions; prepares and interprets land descriptions for incorporation in deeds, leases, etc.

Survey Engineer obtains information for planning or developing an engineering project and estimating its cost, often recording such information in form of an engineering map or plat.

Geodetic Surveyor (or Engineer) plans, performs, or supervises high-accuracy surveys as well as the computations and adjustments thereof, including such as triangulation, traverse, precise leveling, and astronomic observations, such sur-

veys being of a magnitude that the required accuracy and precision can be obtained only through processes that involve figure and size of the earth.

Control Surveyor plans, performs, or supervises surveys and computations of horizontal and vertical measurements involving complex network adjustments, etc.

Topographer plans, performs, or supervises the construction of topographic maps of any scale, contour interval, or accuracy specification, including all surveying procedures and calculations required for such map construction; determines when and whether ground or photogrammetric surveys, or various combinations thereof, shall be used.

Photogrammetrist plans, performs, or supervises use of photogrammetric instruments and techniques in conjunction with various aspects of surveying, mapping, resource surveys, and the design of photo-interpretation systems.

Cartographer plans construction and compilation of charts and maps of small scale; assembles, evaluates, selects, and directs plotting of data therefor.

Map Editor performs many functions of the cartographer; especially designs form and content of maps; determines criteria for symbolization and nomenclature; reviews manuscript maps as to accuracy, completeness, correctness, and conformity with established standards.

The titles mathematician, electronic engineer, geographer, geophysicist, etc., are not defined herein specifically, since they are primarily persons in allied professions whose work only incidentally is in the field of surveying and mapping.

Classification of Positions in Surveying and Mapping

	Professional Level ***	Technician or Pre-Professional Level ****
I. Land Surveying (Cadastral)		
A. Property and Boundary Surveys*	Land Surveyor	Instrumentman
B. Subdivision Surveys and Plats *		Computer
C. Public Lands Surveys *		Draftsman
D. Surveys for Plans and Plats *		Tapeman
1. Architectural (Building-Site) Surveys		Rodman
2. Tax Maps		
II. Engineering Surveys for Design and Construction		
A. Design Data Surveys (including Route Surveys)*	Survey Engineer	Instrumentman Computer
1. Control, Horizontal and Vertical		Draftsman Tapeman
2. Culture and Topography		Rodman
3. Profiles and Cross-Sections		
B. Construction Surveys *		
1. Layout Surveys		
2. Quantity and Measurement Surveys		
3. "As-Built" Surveys a. Utility Surveys		
C. Mine Surveys		
III. Geodetic Surveying, Geodetic Engineering, or Geodesy (not to be confused with precise plane surveying)		
A. Control Surveys, First- and Second-Order Accuracy **	Geodetic Surveyor or	Instrumentman Observer
1. Horizontal: triangulation, traverse, and electronic trilateration	Geodetic Engineer Mathematician	Computer Gravimetric Operator
2. Vertical: spirit and trigonometric leveling		Recorder Signalman
B. Geodetic Astronomy		Tapeman
C. Gravity Surveys, Magnetic Declination Surveys, Figure-of-the-Earth Studies		Rodman
IV. Cartographic Surveying, Cartographic Engineering, or Map and Chart Surveying (surveys for constructing original maps and similar products)		
A. Control Surveys, Third- and Fourth-Order Accuracy **	Control Surveyor	Plane-Table Operator
1. Horizontal		Instrumentman
2. Vertical		Observer
B. Topographic-Planimetric Surveys and Maps *	Topographer	Computer Recorder
1. Photogrammetric Aero-Triangulation	Photogrammetrist	Draftsman Tapeman
2. Mapping Surveys		Rodman
a. Ground-Survey Methods		
b. Photogrammetric Methods		Stereo-Plotter Operator
3. Field-Edit Surveys of Photogrammetric Compilations		
C. Hydrographic Surveys **	Hydrographer	Observer
1. Soundings: fathometer, hand-lead, sounding pole		Recorder Computer
2. Sounding Fixes: three-point, electronic		Draftsman Leadsman
3. Wire-Drag Surveys		
4. Tidal and Current Surveys		
V. Aerial Survey Services		
A. Aerial Photography	Photogrammetrist	Photographer
1. Photo-Interpretation	Electronic Engineer	Photo-lab Technician
B. Electrical Measurements for distances and position fixes (shoran, etc.)	Mathematician Geophysicist	Photo-interpreter Computer
C. Airborne Magnetometer Surveys		Electronic Technician
D. Radar-Altimeter Profiles and Elevations		Magnetometer Operator Radar-altimeter Operator
VI. Cartography (not requiring original surveys)		
A. Map Design	Cartographer	Map Compiler
B. Compilations derived from existing source data	Geographer	
1. Evaluation of Maps and Other Source Data		
2. Nautical and Aeronautical Charts, Topographic and Planimetric Maps, Special-Purpose Maps, etc.		
3. Photomaps and Mosaics		Mosaicker
4. Relief Maps and Models		Modeler
5. Radar-Prediction Charts		
C. Map Editing	Map Editor	
D. Map Reproduction		
1. Engraving or equivalent		Engraver
2. Lithography		Lithographer

* Photogrammetric procedures used when applicable on these and other activities.

** Electronic measuring procedures used when applicable on these and other activities.

*** See definitions following this outline.

**** Including some which are normally skilled craftsmen but which sometimes, by reason of special training, are properly considered technicians, e.g., rodman, tapeman, leadsman, signalman, etc.

Comment and Discussion

The pages of SURVEYING AND MAPPING are open to a free and temperate discussion of all matters pertaining to the interests of the CONGRESS. It is the purpose of this Department to encourage comments and published material or the presentation of new ideas in an informal way.
—EDITOR

FLORIDA STATE BOARD RECOGNIZES PHOTOGRAMMETRY

WALTER S. DIX*—The American Congress on Surveying and Mapping has been advised by Jon S. Beazley, Advisory Council Member from Florida, that the Florida State Board of Engineering Examiners now recognizes photogrammetry as a phase of civil engineering.

The November 1956 examination for C.E. registration included three questions on photogrammetry and three on engineering surveying. This ratio was on a par with such fields of civil engineering as sanitary engineering, drainage engineering, etc. Thus an engineer qualified in civil engineering but devoting his energies to photogrammetry is no longer required to take an examination in fields other than his specialty.

The written examinations, given twice yearly in May and November require that the examinee make a grade of at least 70% of a total of 60 points. The total number of questions to select from varies, but is ample for diversified selection.

Applications for examination must be made at least 90 days before the examination. Graduate civil engineers without experience are eligible for the Engineer in Training (theory) examination. A minimum of four years of experience is required for the Civil Engineer examination. These examinations require eight hours for Theory and eight hours for Design and Practice. A qualifying fee of $35.00 is required.

To surveyors and mappers, Florida's recognition of the broad concept of the application of science in civil or public behalf in the qualification for engineer registration, as against the narrow viewpoint that civil engineering consists only of strucutral design and construction, is of particular and timely interest. The application of theory, knowledge, and ethics in the design and performance of surveys of any sort and by any method in keeping with the best public or civil interest is in a most natural sense public or civil engineering, as is witnessed by recognitions of George Washington by engineering societies as a patriarch of engineering in America, and the fact that his only professional license was that of Land Surveyor, which certificate was issued following examination in 1749 by the College of William and Mary in Virginia.

* Executive Secretary, ACSM.

HONORARY AWARD

RALPH E. DALE*—The citation for procuring new members of the American Congress on Surveying and Mapping came to me as a most pleasant surprise. Thank you for your efforts in my behalf and please convey my gratitude to the Officers and Directors of the Congress.

"Selling" prospective members is an easy and enjoyable hobby in the case of our Congress. Showing a few examples of articles from the Journal, mentioning the aim of the organization, and having an application blank handy usually does the job in a short time, and in nearly every instance the newly recruited become champions of the cause and arouse the interest of other possible joiners.

However, the credit for obtaining our most recent St. Louis members should go, I believe, to others who have had closer contact than I with the prospects. In many instances I merely supplied the application blanks while others—notably William B. Hester and in particular William D. Cannell—did the actual selling. In accepting the Honorary Award, I can do so only with them in mind.

Thank you again.

* 5344 Murdock Avenue, St. Louis 9, Mo.

A.S.C.E. TASK COMMITTEE

PARK L. VERNER*—The interim report of the A.S.C.E. Task Committee on the status of surveying and mapping, dated October 18, 1956†, contains recommendations of vital importance to the Land Surveying profession in California, and undoubtedly in other states as well. In fact, the impact of certain findings will be a stunning one when the implications for the future are more generally understood by the members of the profession who are gaining their daily bread in private practice. It is the purpose of this letter to acquaint the Task Committee with some of the facts of this situation, and to arouse comment from all quarters, particularly in view of the feeling of many professional engineers that letterwriting is a burdensome chore fit only for spare time, of which there is never enough. Thus, the writer hopes to assist the Committee in its expressed desire "to foresee areas of confusion so as to guarantee acceptance with a minimum of friction and delay."

First, because of the striking difference in point of view between the findings of the Task Committee and the California statute definitions of Land Surveying and Civil Engineering, it appears desirable to quote applicable sections of these statutes as follows:

Under Chapter 7 of Division 3 of the Business and Professions Code (The Civil and Professional Engineers Act), Article 3, Section 6730. "In order to safeguard life, health, property and public welfare, any person . . . ." (requires civil engineers to be registered by the State Board.)

Section 6731. "Civil Engineering embraces the following studies or activities in connection with fixed works for irrigation, drainage, water power, water supply, flood control, inland waterways, harbors, municipal improvements, railroads, highways, tunnels, airports and airways, purification of water, sewerage, refuse disposal, foundations, framed and homogeneous structures, buildings, or bridges:

(*a*) The economics of, the use and design of, materials of construction and the determination of their physical qualities.

(*b*) The supervision of the construction of engineering structures.

(*c*) The investigation of the laws, phenomena and forces of nature.

(*d*) Appraisals or valuations;

(*e*) The preparation and/or submission of designs, plans and specifications and engineering reports."

(There follows here a paragraph concerning the exemption of certain small building design from the Act.) Then, the section concludes with:

"Civil engineering also includes city and regional planning insofar as any of the above features are concerned therein, and geodetic, municipal and topographic surveying."

Now, let us examine the Land Surveyors Act, Chapter 15, Division 3 of the Business and Professions Code, Article 3, Section 8726.

"A person practices Land Surveying within the meaning of this Chapter who, either in a public or private capacity, does or offers to do any one or more of the following:

(*a*) Locates, relocates, establishes, reestablishes, or retraces any property line of any parcel of land or any road, right-of-way, easement, alignment or elevation for any of the fixed works embraced within the practice of Civil Engineering, as described in Chapter 7, Division 3 of this Code.

(*b*) Makes any survey for the subdivision or resubdivision of any tract of land.

(*c*) By the use of the principles of Land Surveying determines the position for any monument or reference point which marks a property line, boundary or corner, or sets, resets or replaces any such monument or reference point.

(*d*) Determines the configuration or contour of the earth's surface or the position of fixed objects thereon or related thereto, by means of measuring lines and angles and applying the principles of trigonometry.

(*e*) Geodetic, or cadastral surveying.

(*f*) Determines the information shown or to be shown on any map or document prepared or furnished in connection with any one or more of the functions described in subsections (*a*), (*b*), (*c*), (*d*), and (*e*)."

The remainder of this section is omitted as not applicable to the present question. One more section is needed, however, to complete the picture:

8731. "A registered civil engineer . . . (is) exempt from licensing under this chapter and may engage in the practice of land surveying with the same rights and privileges, and the same duties and responsibilities of a licensed land surveyor."

These two definitions, basically unchanged for

* Licensed Land Surveyor, 2150 The Alameda, San Jose 26, California.

† *See* pages 203–205, inc., of this issue of SURVEYING AND MAPPING.—Ed.

many years during a period of unprecedented land development and construction, appear to have been carefully designed, and to have served well both the public and the professions.

The extent to which the inherent overlapping responsibilities in the surveying field are recognized and provided for is exemplified in the following ways. While the Land Surveyors Act exempts registered civil engineers from being licensed in order to practice land surveying, still, the only mention of surveying under the Civil Engineering definition is included in the final sentence which names geodetic, municipal and topographic surveying. But these three are clearly included within the province of land surveying, also. In addition, only the land surveyor's definition includes construction layout, described with painstaking detail, as well as all surveys made with civil engineering purposes in mind.

This approach to the problem is the only practical one, from the position of those in the profession, or of their clients. It appears to the writer that the Task Committee, in its attempt to carry out a directive which left no room for compromise, has become too concerned with semantics, and has determined to divide the indivisible in order to make the "thing" resemble its name. If land surveyors were simply known as surveyors, their actual day-to-day work would be more clearly described, and the impulse to crowd them all into the cadastral corner might never have arisen. Within the field of surveying, civil engineers and land surveyors have long been rather like Siamese twins, with aims, needs and problems both mutual and reciprocal. The present intention of the Task Committee to apply surgery as a cure for this "unnatural" condition can only be successful (if we *must* operate) if neither of the twins is denied any of its essential parts. The separation, as presently proposed, would certainly leave the Land Surveyor twin with but one leg to stand on, and no body.

The analogy of the Siamese twins is well supported by the recent developments in California leading up to the establishment of the California Council of Civil Engineers and Land Surveyors (no schism here!). In the years following the war, persistent pressure by two locals of the International Brotherhood of Operating Engineers, one in southern California and one in the San Francisco Bay area, to organize the field personnel of engineering and surveying offices, resulted in the spontaneous formation of local associations of engineers and surveyors in private practice to meet the labor problem and to present a united front for bargaining purposes. When the smoke of battle cleared, with the union banner triumphant, members of the associations found that they had a great deal to talk about in terms of common problems, and that if engineers and surveyors could work together effectively on their labor problems, they could also achieve previously unhoped-for benefits in other parts of their common endeavor. So the associations grew and flourished. From informal kaffee-klatches, they have grown to incorporated entities. These regional associations rapidly became aware of each other's existence, and in 1952 held a statewide convention at San Diego, where the California Council of Civil Engineers and Land Surveyors was formed as a foster-parent organization of five original charter groups. At this writing, there are thirteen regional associations, represented in the Council, including some 200 engineering and surveying firms with 385 principals, 25 per cent of whom are Licensed Land Surveyors, closely paralleling the relative percentage of Licensed Surveyors to Registered Civil Engineers as reported in the roster issued by the State Board. The Council is incorporated and has a permanent executive secretary.

The advantages to the members of these common meeting grounds are beyond calculation in dollars and cents. Competitors have become warm friends, finding each other human after all. Employees benefit through cooperative hiring policies by the firms. Clients benefit since better service can be rendered with principals helping each other meet peak pressures with loans of personnel and equipment. Higher standards of workmanship can be encouraged, and helpful ideas exchanged throughout the range of surveying activities.

None of these results could have been realized had there been a sharp line of demarcation between the activities of the Land Surveyors and the Civil Engineers engaged in surveying. Only cooperative effort over common ground could have nurtured these developments, or can sustain them for continued growth.

In another direction, if we examine the findings of the Task Committee within the frame of a surveyor's academic education, as represented by any text on the subject, we have only to thumb through the chapter headings, to find that few if any authors contemplated segregating topographic mapping or construction stak-

ing from the school of the land surveyor. We cannot resist pointing out that since practically all construction layout is referenced to property lines, then the property lines themselves are the initial baselines for construction, and to be consistent, the Task Committee cannot leave even these to the "land" surveyor. Thus, our unfortunate Siamese twin vanishes entirely into limbo beneath the operating table while the surprised surgeon consoles himself with the thought that anyway, the operation *was* logical!

In conclusion, we respectfully petition the Task Committee to reconsider the possibly far-reaching effects of its present position in taking such a restrictive view of the functions of the land surveyor, contrary to established practice and statutory determinations. It may resolve itself into the question, "What's in a name?" Let us rearrange the names, if necessary, to more correctly reflect the facts of life, for it is undoubtedly true that most "land" surveyors are also, in the terminology of the committee, "survey engineers," and this has never been more true than today. In brief, any tendency to deny to Land Surveyors the full field of operations described in the California Land Surveyors Act would create hardship, confusion, and inefficiency. Such is the case in private practice in California, submitted in the confident belief that it must be fairly representative of the rest of the country.

EXTENSION COURSE FOR LAND SURVEYORS IN FLORIDA

ACSM member Hugh A. Binyon of St. Petersburg, Fla., informs us that the Florida Society of Professional Land Surveyors is active with its Education Committee in developing an extension course for land surveyors in Florida.

ACSM member John P. Goggin of Marathon, Fla., down in the Keys, has indicated that most of the instructors have turned in their teaching outlines and were expected to be meeting in April 1957 to correlate the subject materials and coordinate the courses. Chairman Goggin, long an advocate of more education for surveyors at the college level—such as the Canadian system—together with the FSPLS Education Committee, hopefully believes that if they can develop an extension course for Florida surveyors which will attract a large enrollment, the colleges may then be influenced to take greater interest in presenting additonal courses in surveying in their schools.

Mr. Binyon, whose part in the instruction program is "Land Survey Descriptions," says that William C. Wattles of California has been a wonderful help.

—Walter S. Dix

Fourth National Surveying Teachers' Conference

The Fourth National Surveying Teachers' Conference will be held August 5–9, 1957, at Camp F. W. Welch, the Washington State College Summer Surveying Camp, at Naches, Wash.

Camp Welch is located about 50 miles west of Yakima, Wash., on the east slope of the Cascade Range and should be an almost ideal spot for holding a surveying teachers' conference at that time of the year. However, as this announcement will not reach the readers of Surveying and Mapping until the latter part of June, anyone desiring to make arrangements to attend the conference will have to act promptly.

Among the many subjects scheduled for discussion, the following are included: Professional Status of Surveying and Mapping, Use of State Plane Coordinates, Map Accuracy, Research on the Shape of the Earth During the International Geophysical Year, The Future of Surveying in the Civil Engineering Curriculum, Minimum Surveying Program for Civil Engineering Students, Summer Camps, Surveying in the Non-C.E. Curriculum, Photogrammetry, Use of Electronic Computers in Surveying Calculations, Optical Tooling, and Errors.

Further information may be obtained by addressing Elvin G. Ericson, Chairman, Fourth National Surveying Teachers' Conference, Washington State College, Pullman, Wash.

News of Related Organizations

Indiana Society of Professional Land Surveyors

During the business session of the fifth annual Indiana Land Surveyors' Conference, held on the campus of Purdue University, January 18–19, 1957, the following officers were elected for 1957:

President—Arthur F. Buerkle, Lafayette
Vice President—George A. Crowder, Columbus
Secretary-Treasurer—Raymond A. Fickle, Rossville
Executive Secretary (appointed)—Kenneth S. Curtis, Lafayette
Directors:
Robert A. Krull, Hobart
Richard Long, Indianapolis
Samuel E. Brownsten, Crown Point
Bert McClellan, South Bend
Maurice L. Scholl, Connersville
James W. Ehringer, Jeffersonville

Texas Surveyors Association

From *The Texas Surveyor,* Quarterly News Bulletin of the Texas Surveyors Association, Vol. 3, No. 1, January 1957, we learn that the officers of that Association for 1957 are as follows:

President—Chester W. Terry
First Vice President—William H. Wilson*
Second Vice President—Kirby Hillin
Third Vice President—Conrad M. Blucher*
Secretary-Treasurer—William Shirriffs

* Member of ACSM.

South Carolina Society of Registered Land Surveyors

The following is abstracted from a mimeographed bulletin of the South Carolina Society of Registered Land Surveyors under date of May 5, 1957. —EDITOR

Since our winter meeting, Clemson College, in conjunction with the S. C. Society of Registered Land Surveyors held a three-day Surveyor's Short Course on their campus, March 28 through 30. Forty-five surveyors and men interested in surveying attended a series of lectures, demonstrations, and field exercises that were really top notch. It was a "lot of larnin" in a short time, but, from all reports, it was worth while. A lot of credit is due our member, Joe Rostron, who did most of the promotion, and thanks are due to the Engineering Department of Clemson for the excellent way they ran it off. Maybe it can be repeated in a year or two so those who missed it will have a chance!

The Board of Directors met in Columbia on April 17th and established an order of precedence for projects for the Society to work on. President Legare Hamilton gave an interesting report and impression of his trip to Washington and the convention of the American Congress on Surveying and Mapping.

American Standards Association

The Eighth National Conference on Standards will be held at the St. Francis Hotel, San Francisco, November 13–15, 1957. The conference, held for the first time on the West Coast, will meet in conjunction with the thirty-ninth annual meeting of the American Standards Association, which sponsors the conference.

CONGRESS NEWS

Third Annual Joint Meeting of the Southern and Northern California Sections

The Third Annual Joint Meeting of the Southern and Northern California Sections of the American Congress on Surveying and Mapping was held at the Casa Munras Hotel and Cottages—Mark Thomas Inn, at Monterey, Calif., on May 3, 4, and 5, 1957.

Registration started at 1:00 p.m. Exhibits by the following companies were open from 1:00 to 6:00 p.m.

Keuffel & Esser Company, San Francisco,
Charles Bruning Company, Inc.,
The A. Lietz Company,
Los Angeles Scientific Instrument Company, and
Surveyors Service Company, Los Angeles.

The dinner was held at 7:00 p.m., in the Monterey Room of the Casa Munras Hotel. The principal speaker was A. D. Dewey, Corps of Engineers, whose subject was "The Model San Francisco Bay."

From 9:00 to 11:00 a.m., May 4, the exhibits in the Fiesta Room were again open.

The luncheon was held at noon in the Monterey Room, followed by a program which included the following papers:

"The New Role of the Title Company," by L. Herbruck, Vice President, Title Insurance and Trust Co.,

"Education—What Does the Surveyor Want and Need," by Charles R. Herr, Chairman, SCS Committee, Pasadena City College, and C. J. Aggeler, Chairman, NCS Committee, San Francisco City College,

"Leveling in the San Joaquin Valley and Around San Francisco," by Lt. Comdr. Francis X. Popper, Coast and Geodetic Survey, and

"Surveying and Mapping and Legislation," by William C. Wattles, Chairman, SCS Committee, and William A. White, Chairman, NCS Committee.

A dinner dance was held at the Mark Thomas Inn beginning at 7:00 p.m.

Northern California Section

A meeting of the Northern California Section of the American Congress on Surveying and Mapping was held in the Board Room, Public Works Building, Sacramento, Calif., during the evening of Tuesday, April 30, 1957.

Charles F. Fuechsel, Staff Cartographer, U. S. Geological Survey, Washington, D. C., was the principal speaker. His topic was "A Report on the Cartographic Conference held in Stockholm, Sweden."

This conference was the one covered in a paper by Charles S. Spooner, Jr., Army Map Service, at a meeting of the Cartography Division, Washington, D. C., Nov. 15, 1956, and published in SURVEYING AND MAPPING, January–March 1957, Vol. XVII, No. 1, pages 55–58.

Louisiana Section

The Louisiana Section of the American Congress on Surveying and Mapping assembled for the regular quarterly session on February 28, 1597, in the Engineers' Club, DeSoto Hotel, New Orleans, La. Chairman Martin Standard called the meeting to order at 8:00 p.m.

Captain Charles Pierce, Chief, Division of Geodesy, Coast and Geodetic Survey, Washington, D. C., was the guest speaker of the evening. Captain Pierce spoke on the various activities of the Coast and Geodetic Survey throughout this country. His talk was illustrated by means of colored slides.

Captain Pierce also presented a film in color and sound that has just been completed by the Bureau. The film illustrated the latest equipment and methods of surveying used by the Bureau.

—ROBERT BAKER, JR.
Section Editor

Property Surveys Division Seeks Information for Studies

During the 17th Annual Meeting of the American Congress on Surveying and Mapping, the Property Surveys Division presented the following to ACSM:

Resolved, That the Property Surveys Division officially notify *all* of ACSM at the business meeting this afternoon that this Division is studying

1. A proposal for a model surveyor registration act for the land surveying profession,

2. A proposal for the establishment of a standard of ethics for the land surveying profession, and

3. A further study and review of the fees and salary report adopted several years ago by ACSM, and

That the Property Surveys Division invites comments and information on these subjects from any member, Division, or Section of ACSM—such comments and information to be forwarded in duplicate to the Secretary of the Property Surveys Division, who will forward them to the proper officers and committees of PSD.

The resolution above is the result of three resolutions passed by members attending the morning business session for study of these items. These resolutions were as follows:

Resolved, That the chairman of the Property Surveys Division continue the committee set up at the 1956 Annual PSD meeting to study and propose a Model Regislation Law for the land surveying profession. The committee is requested to try, by the 1958 Annual ACSM-PSD meeting, to have a law proposal formulated, omitting if need be the wording of any unsettled portions of such act but at least to have the title sections included in the outline.

Resolved, That the chairman of the PSD establish a committee to investigate and study and propose a standard of ethics for the land surveying profession.

Resolved, That the chairman of PSD establish a committee to study and review the fees and salary report adopted several years ago by ACSM, the committee to report the results of such study and review to the next annual PSD meeting.

—Victor H. Ghent
Secretary, PSD

Personals

Prof. **Russell C. Brinker,** member of the Publications Committee of ACSM, retired on March 1, 1957, from the Civil Engineer Corps, U. S. Naval Reserve, with the rank of rear admiral. Prof. Brinker is head of the Civil Engineering Department, Virginia Polytechnic Institute, Blacksburg, Va.

Rear Admiral **Leo Otis Colbert** (Retired), formerly Director of the Coast and Geodetic Survey, has been named by President Eisenhower to be the Federal representative on the Arizona-California Boundary Commission.

Captain **Ira T. Sanders,** Assistant to the Director, Coast and Geodetic Survey, retired March 31, 1957, after more than thirty-two years service. His assignments have included both sea and shore duty, service in World Wars I and II, and many specialized hydrographic and geodetic survey projects. He is the holder of the Bronze Star Medal, a Gold Star in lieu of a second Bronze Star Medal, and a Naval Unit Commendation ribbon, all in recognition of outstanding service in the Pacific during World War II. Upon retirement he was advanced to the rank of rear admiral because of special commendations by the Secretary of the Navy for the performance of meritorious service in combat.

Announcement has been made that the offices of the **Benjamin E. Beavin** Company have been moved to 104 East 25th Street, Baltimore, Md.

George D. Hardy, formerly with the Abrams Aerial Survey Corporation, Lansing, Mich., has been appointed Operations Manager of the International Aerial Mapping Company, San Antonio, Texas.

L. L. Funk, formerly Assistant District Engineer, District V, San Luis Obispo, Calif., has been promoted to the newly established position of Photogrammetric Engineer, California Division of Highways.

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(*Continued from page 139*)

harbor maneuvering, charts are produced at still larger scales to show all details necessary to provide safe operation in the particular area covered.

Since Great Lakes charts are produced primarily for navigational interests, emphasis is placed upon delineation of soundings, depth contours, and other hydrographic features. Chart symbols, legends, and general construction are in accordance with practices and standards of the nautical charting agencies and the International Hydrographic Bureau. Areas where changes are most rapid are field checked every three years, and revised editions issued at similar intervals. Supplemental information relating to buoys, lights, dredging, and certain land features is obtained from various Federal and State agencies.

Aside from their use in navigation, the charts serve many other purposes for industrial developers, marine contractors, scientists, teachers, fishermen, and vacationists. They are available from the U. S. Lake Survey, 630 Federal Building, Detroit 26, Michigan, by payment of 75 cents each, in advance with the order. A catalogue is furnished free upon request.

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Horizon Camera

A new 360° horizon camera for recording vertical and horizontal images on 35-mm film has been announced by Aero Service Corporation, Philadelphia. The camera is used for making horizon profiles to predict radar or micro-wave patterns in an area, or for plane-table work or similar uses.

First used in surveys for the Distant Early Warning Line station sites in northern Canada, the camera weighs about 20 pounds and mounts on a surveyor's standard tripod. The instrument incorporates a precise level line and is designed to permit very accurate measurement of azimuth angles, in spite of differential shrinkage of its record film or of photographic prints from the film.

The camera is available with a choice of lenses and choice of scales for the azimuth angle. Current models use a 12-inch or 20-inch lens and have horizon scales of approximately 5° and 10° per inch. A flare-reducing mask permits photographing almost directly into the sun with good results.

Set up and leveling for the horizon camera follows the same routines as in setting up a surveyor's level. The camera turns through its 360° arc in approximately one minute, the speed of its turning being preset to control the exposure time. The constant speed drive motor is operated by a 24-volt battery.

Film capacity is approximately 400 feet. The film chambers are darkroom loaded but may be installed or changed in daylight, so different films may be used as required to penetrate ground haze. Infrared and panchromatic are the principal types of films used.

"Horizon Camera"

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The Story of Maps

"The Story of Maps," an attractive and colorful teaching aid, has been prepared by General Drafting Company, for Esso Standard Oil Company. The 16-page pamphlet, in picture-book format, traces the history of maps and mapmaking with well-captioned drawings. It also illustrates the various steps in mapmaking, from field and aerial surveys through drafting and reproduction. There is also a page on "how to use your road map" and a glossary of map terms. Teachers may request copies of "The Story of Maps" from Public Relations Department, Esso Standard Oil Company, 15 West 51st Street, New York 19, N. Y., or from any of Esso's division or refinery offices.

—W. W. RISTOW

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Reprints in quantities of 50 or more may be obtained of any article appearing in this issue. Orders must be placed with the Editor-in-Chief, Howard S. Rappleye, 6712 4th St., N.W., Washington 12, D. C., not later than 3 weeks after publication. Authors who wish reprints of their articles may so indicate when manuscripts are submitted. Approximate prices of reprints follow:

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Units of Area in ye Olden Days

A letter, dated February 4, 1957, and addressed to the Chairman of the Publications Committee by ACSM member Rush W. Boyer, County Surveyor, Stafford County, Va., led us by a somewhat devious route to a small book in the Library of Congress (L. C. No. PA6156 C3D4 1934d) the title page of which reads as follows: "Marcus Porcius Cato on Agriculture Marcus Terentius Varro on Agriculture with an English Translation by William Davis Hooper, A.M., Litt D. University of Georgia Revised by Harrison Boyd Ash, Ph.D. University of Pennsylvania Cambridge, Massachusetts, Harvard University Press London William Heinemann Ltd. MCMXXXIV". The following, quoted from page 207 of this book, is published as being of possible interest, and perhaps some consolation, to those readers who are at present struggling with chains and links, varas, meters, and feet. —EDITOR

"Each country has its own method of measuring land. Thus in farther Spain the unit of measure is the *iugum,* in Campania the *versus,* with us here in the district of Rome and in Latium the *iugerum.* The *iugum* is the amount of land which a yoke of oxen can plough in a day; the *versus* is an area 100 feet square; the *iugerum* an area containing two square *actus.* The square *actus,* which is an area 120 feet in each direction, is called in Latin *acnua.* The smallest section of the *iugerum,* an area 10 feet square, is called a *scripulum;* and hence surveyors sometimes speak of the odd fractions of land above the *iugerum* as an *uncia* or a *sextans,* or the like; for the *iugerum* contains 288 *scripula,* which was the weight of the old pound before the Punic War.[1] Two *iugera* form a *haeredium,* from the fact that this amount was said to have been first allotted to each citizen by Romulus, as the amount that could be transmitted by will. Later on 100 *haeredia* were called a *centuria;* this is a square area, each side being 2400 feet long. Further, four such *centuriae,* united in such a way that there are two on each side, are called a *saltus* in the distribution of public lands."

[1] Meaning that the surveyors used, for the fractions of land, words which properly applied to fractions of the pound.

The Land Surveyor in the Fifth and Sixth Century*

The following is a condensed translation of a letter written by Cassiodorus who was Latin Secretary to the Ostrogothic king Theodoric. The translation is taken from a work by Dr. Thomas Hodgkin (Variae, III, 52, p. 232 f.)

The professors of this science are honoured with a more earnest attention than falls to the lot of any other philosophers. Arithmetic, Theoretical Geometry, Astronomy, and Music are discoursed upon to listless audiences, sometimes to empty benches. But the land surveyor is like a judge, the deserted fields become his forum, crowded with eager spectators. You would fancy him a madman when you see him walking along the most devious paths. But in truth he is seeking for the traces of lost facts in rough woods and thickets. He walks not as other men walk. His path is the book from which he reads. He shows what he is saying; he proves what he has learned; by his steps he divides the rights of hostile claimants; and, like a mighty river, he takes away the fields of one side to bestow them on the other. Wherefore, acting on our instructions, choose such a land surveyor, whose authority may be sufficient to settle this dispute, that the litigants may henceforth cultivate their lands in peace.

* Reprinted from *The Canadian Surveyor,* Vol. 13, No. 6, January 1957.

Map Prices Increased

The following prices and discounts for maps distributed by the Geological Survey became effective May 1, 1957.

List Price—The list price of topographic quadrangle maps at scales 1: 24,000; 1: 31,680; 1: 62,500; 1: 125,000 and 1: 250,000 ($1° \times 1°$ reconnaissance series) is 30 cents each.

The list price of topographic maps at scale 1: 250,000 (new $1° \times 2°$ series) is 50 cents each.

National Park and other special topographic maps are individually priced. A price list is available upon request.

Discounts—A discount of 20 percent is allowed on all orders which amount to $10 or more at the list price.

A discount of 40 percent is allowed on all orders which amount to $60 or more at the list price.

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NEW GURLEY CATALOG

A new 68-page two-color catalog has been issued by W. & L. E. Gurley, Troy, N. Y. This profusely illustrated book described in detail the line of instruments and other equipment offered by that company. The new "Catalog No. 50" is available to practicing engineers, surveyors, and students of engineering who request it by letter.

SURVEYOR ORGANIZATIONS

The American Congress on Surveying and Mapping has been informed that engineers and surveyors of Anne Arundel County, in the State of Maryland, have formed the Anne Arundel County Society of Engineers and Land Surveyors.

ACSM has also been advised that the "Land Surveyors' Association of King County," in the State of Washington, has expanded and constitutionally changed its name to "Land Surveyors' Association of Washington." This active group is affiliated with ACSM.

DENOYER-GEPPERT CATALOG

Anyone who has any doubts that maps and charts constitute a large item in visual education in this day and age should look over the new "Catalog 57" recently issued by the Denoyer-Geppert Company, 5235–59 Ravenswood Ave., Chicago 40, Ill.

Slanted primarily to the needs of the classroom, this 64-page catalog—much of it in color—lists a wide variety of globes, as well as maps and charts of everything from the world to a man's "innards."

Copies are available on request.

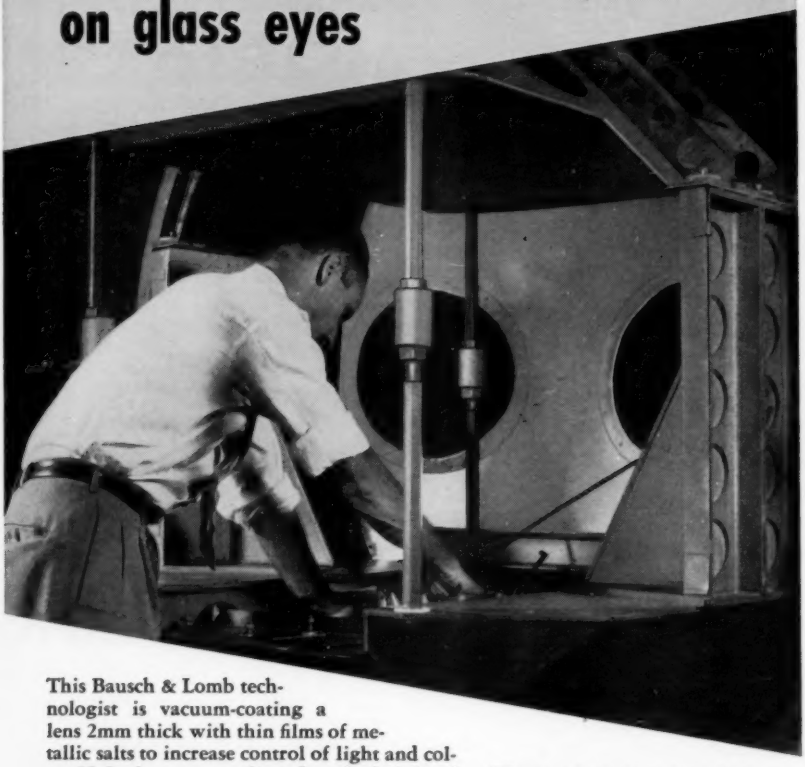
SHORAN CONTROL IN GUATEMALA

Flying of a Shoran-guided airborne magnetometer survey over 40,000 square kilometers of unmapped jungle in northern Guatemala was started during February 1957. Aero Service Corporation is performing the survey for 15 major oil companies.

The Shoran data will provide 200 control points as the network for ground surveys to establish boundaries of concessions to oil companies. This is believed to be the first such use of Shoran for land surveys.

Important field and technical aid will be given by the Direccion General de Cartografia of Guatemala, the Inter-American Geodetic Survey, and other interested government agencies in Guatemala.

Grafting metal skin on glass eyes



This Bausch & Lomb technologist is vacuum-coating a lens 2mm thick with thin films of metallic salts to increase control of light and color. If the lens were enlarged to the height of Mt. Washington (6,288'), the lens coating would be equivalent to a four-inch transparent layer. This submicroscopic surfacing method, developed by B&L, makes possible miracles in selective reflectance and transmittance of light of any specified wavelengths. Practical applications range from color TV to directional control of guided missiles. How does this kind of advance technology fit in with your contract plans?

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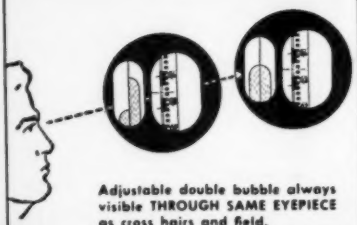

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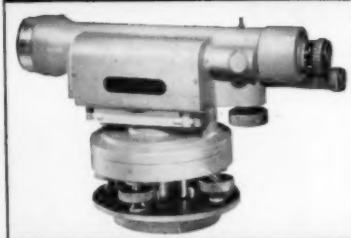

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NEW YORK CANAL BOOK

A new edition of *New York Canal Book* has been released by the U. S. Lake Survey. This is a loose-leaf-style bound volume of 60 charts, scale 3 inches = 1 mile, overall size 11 × 17 inches, covering all the canals east of Lyons, and including a line drawing of the route of the canal between Lyons and Tonawanda on the Niagara River. (Edition of 1956).

The price of this publication is $2.25 and it may be obtained from the U. S. Lake Survey, 630 Federal Building, Detroit 26, Mich. Remittances should be by post office money order or draft on a United States bank and should be made payable to the Treasurer of the United States.

SURFACE WATER TEMPERATURES

Special Publication No. 280, *Surface Water Temperatures* at Tide Stations, Pacific Coast, North and South America and Pacific Ocean Islands, has been published by the Coast and Geodetic Survey. This publication is one of a series of temperature and density publications which are revised every four years.

Sea water temperature data are presented in tables based on observations made in Pacific harbor and coastal waters through 1955. Temperatures were observed primarily at tide stations maintained by the Coast and Geodetic Survey, often with cooperation from other organizations. For other countries the data were derived from observations made by organizations in the countries concerned.

Monthly mean temperatures and yearly mean and extremes for each year of observation are given for each of 127 stations. Also given for the series of observations are the mean of the monthly means, the maximum observed, the mean of the monthly maxima, the mean of the monthly minima, and the minimum observed. At some stations, recording thermometers provide a temperature record in the form of a continuous trace. The monthly mean values are computed from hourly tabulations. The monthly maximum and minimum represent the highest and lowest points of the trace.

Data are also presented graphically to show the temperature trend during the year at many of the places. Also included is a table for converting the Fahrenheit temperatures to centigrade.

Copies of the publication may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for $0.45 each.

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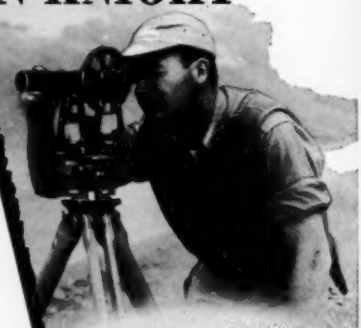

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The Model 255A employs a transducer which has a beam width of only 6 degrees at the 10 db point, which results in greater detail within a relatively small area. Lessening the penetration of signals into silt or mud gives extremely precise indication of the actual depth and contour of the bottom.

For measuring dredging operations, silt, sharp slopes, the Model 255A is recommended. For general survey, deep depth and penetration, the standard Model 255, with beam width of 20 degrees at the 10 db point and with accuracy within one-half of one per cent, is recommended.

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Coast and Geodetic Survey Studies Magnetic Currents Reaching Earth from Space

During the International Geophysical Year, which begins July 1, 1957, the Coast and Geodetic Survey, U. S. Department of Commerce, hopes to solve some of the mysteries surrounding the magnetic currents that reach the earth from the outer atmosphere.

A number of questions concern the enormous streams of electricity, hundreds of miles above the earth, which are believed to cause the disturbances called the magnetic storms. Just where are these currents, how far up, and how powerful? Is there an electric "jet stream" near the equator, like the jet stream of air that aviators know? What is the connection between magnetic storms and the northern and southern auroral displays?

The Survey will conduct most of the American magnetic studies for the IGY. Since 1843 it has made observations of the earth's magnetism in order to show on mariners' charts how the effect on the compass needle varies. Now that the Survey also publishes millions of charts every year for flyers, this "magnetic declination" of the compass is even more important. Magnetism also affects another of the navigator's instruments, the radio, in such matters as fadeouts.

Magnetic forces come from two sources. The strongest come from deep in the earth and are relatively stable. They do, however, undergo changes over the years or over scores of years which must be reflected in the charts.

The hour-to-hour and day-to-day fluctuations originate above the earth's surface and are related to sunspots and the aurora. These rapid changes are to be given particular study during the IGY.

THE LOST HAMMER AND THE PIECE OF SHRAPNEL

The Survey has seven permanent magnetic observatories in the United States, Alaska, Puerto Rico, and Hawaii. It will add two temporary observatories and about 15 portable "stations" in the United States and Alaska.

New instruments are being added to the regular observatories in Fredericksburg, Va.; Tucson, Ariz.; College, Barrow, and Sitka, Alaska; San Juan, Puerto Rico; and Honolulu, Hawaii. The observatory buildings are modest in appearance but unique in construction, for they must contain no magnetic materials. Now and then a carpenter's hammer, lost between the walls, has thrown the instruments off. Iron nails cannot be used, so aluminum and copper have been substituted. Aluminum is preferred, because it makes nails that are stiff enough to be driven without the drilling of holes. Certain kinds of concrete, of mortar, and even of asbestos have to be shunned.

Traffic, nearby machinery, and stray electric currents leaking through the ground are other hazards for the scientists. A railroad electrified with direct current can cause hopeless disturbances in a laboratory many miles away.

For no apparent reason, one war veteran on the staff had great difficulty operating the instruments. Finally it was discovered that he still had a piece of shrapnel in his right hand.

In the Far North, magnetic observations have been confused because curious natives came to watch the proceedings, with shotguns crooked in their arms.

The buildings must also be heavily insulated, to prevent temperature changes from affecting instruments, and they must be light-proofed, because the records are made on photographic paper.

The observatory at College, near the University of Alaska, has half a dozen buildings and has just completed two "slave" stations seven miles away, connected to the master instruments by cable. This grouping is expected to give a space effect in the recorded data, instead of information taken at a single point.

During the IGY the Survey will have temporary observatories at Big Delta and Healy, Alaska. These will be housed in prefabricated buildings, but will be equipped with instruments like those at the regular establishments. The six or eight automatic stations to be scattered over Alaska will have no resident observers, but will be visited at intervals of a week or longer by traveling supervisors. They will be used to gather data on the relationships between magnetic disturbances and auroral displays.

Some eight portable instruments will be set up in the western United States to determine the possible relationships between magnetism and weather. The work will center at Harvard University's solar observatory in Climax, Colo.

VANTAGE POINTS IN THE PACIFIC

In the Pacific, the Survey will supplement the work of its Honolulu magnetic observatory with temporary observatories on Guam, in the Marianas, and on Koror in the Palau Group. They

will have standard instruments and will be housed in prefabricated aluminum shelters insulated from the heat.

Jointly with the Scripps Institution of Oceanography, the Survey will operate three more in the central Pacific—on the American islands of Jarvis and Palmyra and on Britain's Fanning Island. The three will be visited periodically by a schooner skippered by a young scientist, Dr. Martin J. Vitousek of Honolulu.

MYSTERIES FROM THE SUN

Man is trying, through the IGY, to get a better understanding of strange forces that appear to originate in the sun. Besides magnetic storms, minor disturbances are reflected in the Survey's instruments. Other products of the currents in the upper air are auroral displays (aurora borealis in the North and aurora australis in the South), a night shine called airglow, and even chemical changes in air particles. An intense solar flare near the center of the sun's disk (a flare is an intensification of light, the opposite of a sun spot) is often followed, a day or two later, by a sudden magnetic storm that envelops the earth.

The more than 5,000 engineers and scientists of more than 50 countries, cooperating in the IGY, hope to broaden their knowledge by looking at the same phenomena from many different points. They do not know everything they will achieve, but scientists are always hoping for a breakthrough—for a sudden discovery of new principles important to human life. The Survey is one of many U. S. Agencies taking part.

GRAPHS AT THE SOUTH POLE

The Coast and Geodetic Survey has posted three observers with special magnetic instruments at stations established by the IGY in Antarctica. Ronald Viets is at the Little America station, Leo Davis at Byrd, and Richard Berkley at Wilkes on the Knox Coast. Willi Hough of the National Bureau of Standards (like the Survey, an agency of the Department of Commerce) will man a Survey instrument at the South Pole. The Survey is also lending a magnetograph to the New Zealanders for use at Cape Adare near McMurdo Sound.

The study of earthquakes is a Coast Survey function. The bureau is supplying seven seismographs to the IGY organization for records to be made at Byrd and the South Pole stations.

The Antarctic observations are a part of IGY's worldwide assault on the secrets of nature. They are much broader in scope than those made during the First International Polar Year in 1882–83 and the Second International Polar Year in 1932–33. Both of these concentrated on the north polar regions.

SIGHTING THE MOON AND STARS

The American studies of magnetism, directed by the Coast and Geodetic Survey, will be more elaborate than those of any other participating country, with the possible exception of Russia. From the IGY Congressional appropriations, $1,500,000 has been allotted for the magnetic program.

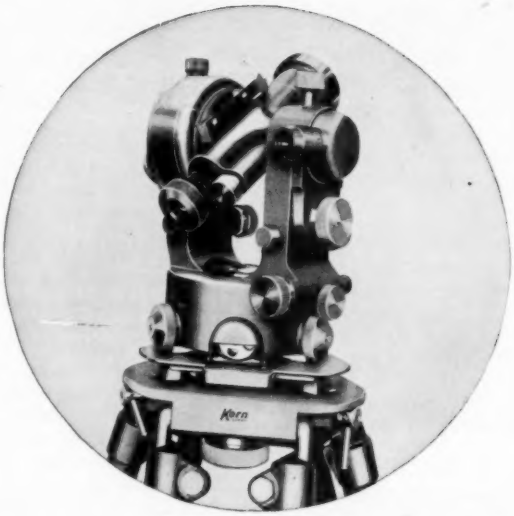
The Bureau will gather data also on seismology, latitude and longitude, and oceanography—the geography of the sea.

In its regular latitude observations, the Survey uses two permanent observatories, at Gaithersburg, Md., and Ukiah, Calif. As a part of the IGY program it will also operate a special world station in temporary buildings near Honolulu. Here, taking sights on the stars, observers will use an astrolabe invented by André Danjon, Director of the Paris Observatory, and, for time and position calculations, a moon camera developed by Dr. William Markowitz, Director of Time Service at the Naval Observatory, Washington. Around the world the IGY will have about 20 stations similarly equipped, two of them in the United States.

One scientific theory is that the continents change their position slightly over hundreds of years. Only recently have instruments been developed which are sufficiently accurate to detect small shifts. Any continental "drift" that has taken place in the last few years will be detected by the IGY astronomic observations.

For studies of ocean movements, the Survey will make available data from its tide-gaging stations, especially those on the Pacific islands. It will also lend ten of its tide gages to the Scripps Institution of Oceanography and the Lamont Geological Observatory of Columbia University, to be installed on islands in the Atlantic and Pacific Oceans not now provided with them. The machines, which are unattended but serviced every few days, keep a continuous record of tides. The Survey has 14 tide gages in operation on Pacific islands, and 95 in all.

Captain Elliott B. Roberts, Chief, Division of Geophysics, represents the Bureau on IGY's United States National Committee. The National Bureau of Standards and the Weather Bureau, other agencies of the Commerce Department, are also represented.



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Electronic Computers[1]

ANALOG COMPUTER

Recent additions of new equipment to the Engineering Experiment Station Electronic Analog Computer (EESEAC) have increased the versatility and usefulness of this problem solving facility. Operations which may now be performed on the computer include simulation of dynamic systems and the solution of linear, non-linear, and variable coefficient differential equations, and finite difference equations with arbitrary boundary conditions and forcing functions. Example problems include heat flow, beam deflection analysis, aircraft stability, pipeline studies, oil recovery problems, cylindrical flow reactor design, dynamic mechanical studies, and other steady state and transient problems from the various fields of engineering. Present research on the computer is being directed toward improving the accuracy and reliability of the existing installation and investigating means of further extending the range of usefulness of the computer.

DIGITAL COMPUTER

An IBM 650-Magnetic Drum Data Processing Machine was placed in operation by the Texas Engineering Experiment Station in August 1956.

This computer is being used by various research activities of the Texas A. & M. College System as a numerical analysis research tool as well as a teaching device to acquaint students with the latest advances in the field of digital computer.

The present trend to industry to the use of large scale digital computers is opening up a new area of research and allowing research workers to undertake problems which have long been considered impossible due to the amount of calculation required to arrive at a solution.

In addition to the computer, the laboratory contains all the auxiliary punched-card equipment such as key-punch, verifier, sorter, and printer which are necessary to accomplish assigned tasks.

Three types of work presently being done on the 650 are:

1. Private Research—Staff members and students of the Texas A. & M. College System are making use of the 650 on a no-charge basis to conduct personal research projects for which no funds are available.

2. Sponsored Research—Various sponsored research projects being conducted on the A. & M. College campus are making use of the facilities of the computer laboratory which are made available to such projects at a nominal cost.

3. Industrial Research—Industrial research is being done by the computer laboratory on a fee basis which makes large computing facilities available at reasonable cost to even the smallest industries of the State.

The computer has been used to solve problems in heat transfer, cooling tower design, storm tides, wave forces, atomic physics, and agricultural statistics. Programs are presently being developed to solve problems in the fields of civil, electrical, mechanical, and petroleum engineering.

In order to meet the educational demands of industry, A. & M. College is currently offering courses in:

1. Principles of digital computers.
2. Programming of digital computers.
3. Data processing.
4. Numerical analysis.

In each of these courses practical laboratory assignments are conducted on the 650 machine.

The computer laboratory is staffed with trained personnel who are capable of programming the computer for the solution of various problems.

[1] Reprinted by permission from "Activities of the Texas Engineering Experiment Station for 1954–55 and 1955–56"—Research Report No. 57, December 1956, The Texas A. & M. College System.

Plane Coordinate Intersection Tables

Announcement has been made by the Coast and Geodetic Survey, U. S. Department of Commerce, of the publication of two more of the series of plane coordinate intersection tables. The States covered by the latest publications are Alabama (Publication 65-1, Part 1, 50 cents) and Oklahoma (Publication 65-1, Part 34, 60 cents).

These tables contain plain coordinates for 2½-minute intersections within the limits of the States, based on the plane coordinate systems established by the Coast and Geodetic Survey.

Copies of these publications may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at the prices noted above.

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LAZY

The following story was told to me by Captain F. L. Gallen, Coast and Geodetic Survey, back in the summer of 1951. EDITOR

Years ago I had a kid on a wire-drag party and he was the laziest chap I ever saw. Whenever I wanted him for anything he was always asleep on the quarterdeck. I said to him one day, "You are so damned lazy! What are you going to be when you grow up?

The kid replied, "You know, sir, my one ambition is to become the navigating officer on a lightship!"

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Recent Maps of Antarctica

Renewed and intensified activity in Antarctica, related to the program of the International Geophysical Year, has stimulated interest in maps of the South Pole region. A useful list of 21 "Recent Maps of Antarctica," compiled by George R. Dalphin and Ena Yonge, has been published in the December 1956 issue of the *Geography and Map Division Bulletin,* Special Libraries Association. Subscriptions for this quarterly publication, at $2.00 per year, may be placed with Robert W. Lovett, c/o Baker Library, Harvard Business School, Boston 63, Mass. Individual issues are $0.75 each.

—WALTER W. RISTOW
Library of Congress

Coast and Geodetic Survey Sesquicentennial Dinner

The sesquicentennial dinner, Coast and Geodetic Survey, was held in the Presidential Room, Hotel Statler, Washington, D. C., on Tuesday evening, Feb. 5, 1957. Approximately 500 persons attended, including heads and officials of other government agencies and scientific organizations, representatives of commercial organizations, and officers and personnel of the Bureau.

During the course of the dinner, President Eisenhower came to the banquet room and spoke briefly on the significance of the 150th birthday party. In his remarks he said, "If you feel as I do that the Coast and Geodetic Survey has done its duty for 150 years, you could not wish for more."

Other speakers included the Honorable Henry de Torrente, Minister of Switzerland; the Honorable Sinclair Weeks, Secretary of Commerce; and Admiral H. Arnold Karo, Director of the Coast and Geodetic Survey. The Honorable Walter Williams, Under Secretary of Commerce, was the toastmaster.

Lists of Published Maps

The Map Information Office, U. S. Geological Survey, has recently issued lists of maps published by various official and nonofficial map publishers. All lists include prices of individual maps and addresses to which orders may be sent.

City Area Maps (MIO-77, March 1957). Lists 34 special topographic maps of cities and adjacent areas published on single sheets at the scale of 1:24,000.

Maps of the United States, Published by the Geological Survey (MIO-1, October 1956). Gives description, size, scale, and price for 12 different maps.

Maps of the World (MIO-64, April 1957). Includes descriptions of several large world maps, with prices, and publishers' addresses.

Maps of the United States (MIO-2, April 1956). A selected list of a number of commonly used maps of the United States, published by Federal agencies other than the Geological Survey.

Government Maps (MIO-79, August 1956). Gives brief descriptions for a selection of Government maps which have had widespread appeal and use.

Aerial Photography of Areas Covered by the Set of One Hundred Topographic Maps Illustrating Physiographic Features, (1956). Shows the photo indexes to the aerial photography available from Federal agencies, from which the prospective purchaser can make his own selection of prints.

State Geologic Map Indexes (MIO-67, April 1956). Lists available indexes which show areas for which geologic maps have been published.

Checklist of Current Indexes to Topographic Mapping (MIO-6, March 1957). The list includes publication dates of available indexes as well as estimated publication dates for projected new editions.

Price List Special Topographic and Base Maps. Gives new prices (effective May 1, 1957) for maps published by the U. S. Geological Survey.

The above lists are available, without charge, from the Map Information Office, U. S. Geological Survey, Department of the Interior, Washington 25, D. C.

—W. W. RISTOW

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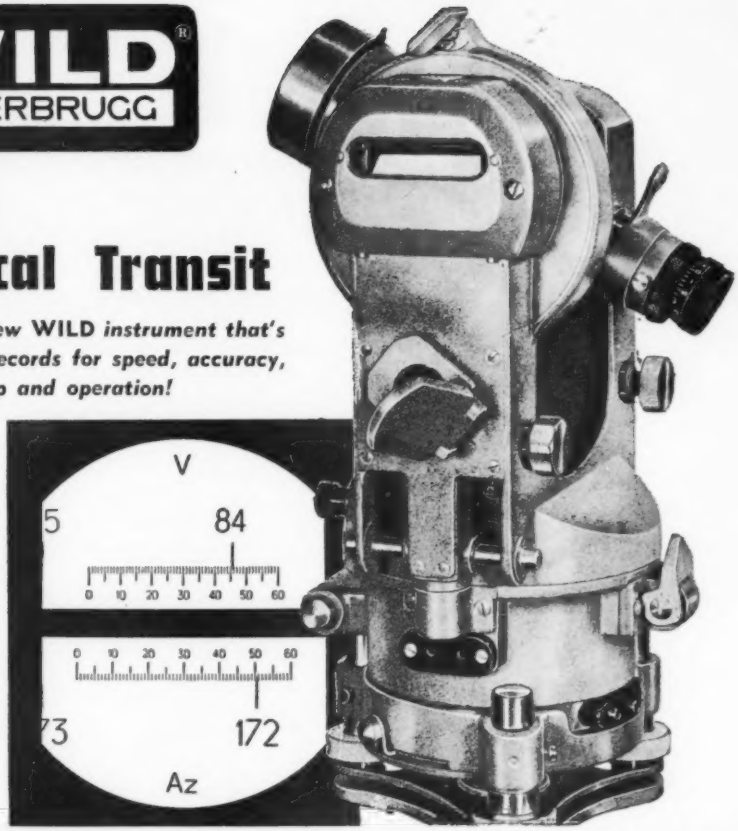

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